Interpretive Investigation into the Implementation of Sustainable Business Models within Saudi Housing Construction Industry

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Abstract

Sustainable Practices (SPs) in the Housing Construction Industry (HCI) have been the subject of significant innovation, resolving housing problems and reducing the negative impacts of the built environment. These enhancements have targeted the value creation process. Addressing isolated parts of the Business Models (BMs) used by Housing Construction Companies (HCCs). The BM approach describes the logic organisations create, deliver and capture value. However, ways in which HCCs can develop and introduce fundamental changes to create profitable Sustainable Business Models (SBMs) remain poorly researched. This research explores the transition to SBMs in the Saudi Arabian HCI empirically by adopting nine elements extracted from business and management. Twenty-two interviews take place with a diverse sample of three groups of stakeholders in the HCI. The emergent outcomes are validated and refined by focus group, following Interpretive Structural Modelling (ISM) procedures. A BM is considered sustainable when a business aligns socio-environmental responsibility with economic benefits by focussing on sustained value creation. For this, the role of clients/participants is key; they must be incentivised and engaged in the value chain to minimise waste and environmental damage for the long-term benefits of the organisation. The key outcomes show that the SBMs framework can link business cases with sustainability in an organised approach. This indicates that SBM transition needs changes in the business environment, i.e., awareness, top management mindsets, political change, value chain upgrade, media support, engagement and collaboration with the public sector. Discussions on challenges facing implementation highlight the global challenges driven by a broad set of social, political, legal, economical, technological innovation and general trends towards a deteriorating environmental resource. The research establishes the association between various SBM elements, confirming that the SVP, TC and CS represent the groundwork of the SBMs framework. The guideline followed the experts recommendations to supports the implantation with set of recommendations begins with the cognisance of top management and promotes sustainable demand converted into SVPs. It highlights both the role of a panel to support the movement and the importance of identifying partner stakeholders for the transformation. Finally, the guideline recommends reviewing and monitoring points to be fed to top management.

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Dedication

I dedicate this work to the soul of my mother Zehabah, may Allah rest her soul in peace.

List of Publications

Alshahrani, A. ‘Business model innovation for the delivery of sustainable housing in the Kingdom of Saudi Arabia’ (2017), 13th International Postgraduate Research Conference, United Kingdom, Salford 14th-15th September.

Alshahrani, A. ‘Sustainable business model for housing construction in the Kingdom of Saudi Arabia’ (2018), Salford Postgraduate Annual Research Conference, United Kingdom, Salford 4th-5th July.

List of Abbreviations

BC	Business Case
BM	Business Model
BIM	Building Information Modelling
CR	Customer Relationship
CS	Cost Structure
DC	Distribution Channel
ECRA	Electricity and Co-Generation Regulatory Authority
GCC	The Gulf Cooperation Council
KACARE	King Abdullah City for Atomic and Renewable Energy
KACST	King Abdulaziz City for Science and Technology
KAUST	King Abdullah University of Science and Technology
KR	Key Resources
LEH/ZEH	Low Energy home/Zero Energy Home
PESTEL	Political,Economic,Social,Technological,Environmental,Legal
PH/ OSC	Prefabrication Home/Off- Site Construction
PN	Partner Network
RM	Revenue Model
SBM	Sustainable Business Model
SGBF	Saudi Green Building Forum
SHC	Sustainable Housing Construction
SHD	Sustainable Housing Development
SHP	Sustainable Housing Practice
SVP	Sustainable Value Proposition
TBL/3BL	Triple Bottom Line
TC	Target Customer
VC	Value Configuration
VP	Value Proposition
ZCH	Zero Carbon Home

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Introduction to the Research

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Chapter 1. Research Introduction

1.1 Research Background

Correlation between economic growth and concern about the environment and society was acknowledged in the UN Stockholm Conference in 1972. Fifteen years later, in 1987, the World Commission on Environment and Development (WCED) published a seminal report titled, 'Our Common Future', which eventually became known as the Brundtland Commission Report (Jackson, 2009; Sachs, 2016). This important document introduced the idea of Sustainable Development Goals (SDGs) into the political and public spheres by highlighting the importance of sustainability to future global development. It argued that human advances should fulfil the needs of present generations without using non-renewable resources that would be needed by future generations (World Commission on Environment and Development, 1987). This report raised the public profile of SDGs, emphasising the need to take immediate action to prevent dangerous consequences for future generations.

As the Kingdom of Saudi Arabia (KSA) is experiencing rapid urbanisation and a scarcity of resources, the government is motivating the construction industry to implement sustainable practices. Consequently, over the last few years, significant progress in terms of green buildings has been made (Asif, 2016; Susilawati & Al Surf, 2011; Taleb & Sharples, 2011). Several governmental policies have suggested that there is increasing political support for Sustainable Housing Practices (SHPs) in the form of new building regulations and large zero-carbon developments (Abubakar & Dano, 2019). Examples of this are in the Vision 2030 policy, and the associated National Transformation Plan 2020 (NTP 2020) and Housing Program Delivery Plan (HPDP), which advocate economic diversification and inclusion of sustainability as part of the increasing environmental awareness and modernisation of society (NTP, 2016; Taher & Hajjar, 2014; Vision 2030, 2016). The benefits of transitioning to sustainable business practices seem to be crucial for the Saudi Housing Construction Industry (HCI), especially when one considers the potential for preserving the country's resources for future generations by minimising present and future housing energy demands (Asif, 2016), which are currently met by oil. The growing population of the country indicates that by 2050, housing energy demands will have reached

120 GW, requiring 8 million barrels of oil per day (Husain & Khalil, 2013). This high demand for energy will not only increase pressure on Saudi Arabia, but will also place added pressure worldwide, as Saudi is the world's largest exporter of oil.

At present, Saudi Arabia is dependent on oil exports to fund projects. The country has the second largest oil reserves globally; equal to 266.5 billion barrels. However, these oil reserves are not expected to last forever (Dipaola, 2016), thus highlighting a pressing need for policies and actions from the private sector to allow the country to reduce its dependence on oil and adopt sustainable building practices, including SHPs (Al Surf, 2013). Over time, the price of oil and natural gas has decreased (Al-Maamary, Kazem, & Chaichan, 2016), having a negative impact on oil exportation countries, which have announced new energy prices. Moreover, the Saudi government announced that it would implement a broad-based five-year reform with an increase in energy prices, including fuel, electricity and water, from the beginning of 2016 (KAPSARC, 2016).

Since 2014, the Saudi Arabian government has adopted numerous sustainable development initiatives in the country, such as the King Abdullah Petroleum Studies and Research Centre (KAPSARC), which has a residential community and mixed-use buildings that have been accredited with Leadership in Energy and Environmental Design (LEED) Gold (Attia, 2013; Landreneau, 2012). Moreover, the Saudi Green Building Forum (SGBF) states that investments of more than US$26 billion are expected to allow the construction of approximately 76 green building projects (Asif, 2016; Al Surf & Mostafa, 2017). On the other hand, in more recent years, particularly 2015, Saudi Arabia adopted the 2030 Agenda for SDGs, comprising 17 sustainable development goals aimed at ending poverty, combatting discrimination and injustice, and seeking to deal with climate change by 2030 (Sustainable Development Goals, 2016). With respect to housing in particular, which is the focus of this research, no housing has yet been accredited by other green rating systems, which indicates that sustainability has not yet been adequately incorporated into the HCI in Saudi Arabia (Attia, 2013). This is probably due to the obstacles and barriers faced when implementing sustainability in the HCI in Saudi Arabia.

The need for new models in the HCI becomes even more apparent when one considers the current housing shortage in Saudi Arabia (Al Surf, Susilawati, & Trigunarsyah, 2014), which had reached an estimated shortfall of 1.7 million houses in 2016 (Alrashed & Asif, 2014). If these new properties are built, they will undoubtedly further increase the energy demands of the country's housing stock. Striving to meet the increasing demand for housing by using existing, non-sustainable practices, would unquestionably add significant amounts of greenhouse gases, both nationally and worldwide (Alrashed & Asif, 2014).

With the growth in size and intensity, Business Models (BMs) are being viewed as potential building blocks for sustainable growth (Aho, 2013; Sommer, 2012). The concept of the BM gained popularity during the end of the twentieth century and soon the BM was considered a new tool for analysis and management planning (Osterwalder, 2004). The BM has been defined as 'a blueprint of the value proposition offered to the customer, the way the business organises itself to create and deliver that value and generate profits from it' (Sommer, 2012). By using the original BM as a starting point, this approach can help bring much needed change to the industry (Aho, 2013; Sommer, 2012). Developing Sustainable Business Models (SBMs) framework that promotes a wider range of sustainable practices would require a comprehensive understanding of the issues at hand, and an awareness of potential future trends, which would help shape the sector. By focussing on modification of the BM, industries can begin the process of switching to more global friendly initiatives.

Designing a SBMs framework requires knowledge and understanding of the traditional BMs that allow growth and remain competitive (Jang, Ahn, Park, Lee & Kwon, 2019). The structure of the SBM is reflected in the core of the BM, while simultaneously addressing protection of environmental, societal and economic assets (Boons & Lüdeke-Freund, 2013). SBMs are defined as models that minimise their long-lasting impact on the environment and society, while remaining profitable (Girotra & Netessine, 2013). However, during innovation and development, financial goals should not be the only focus; social and environmental protection goals should also be addressed. The SBM is seen as a tool for leveraging those goals.

The construction industry is failing in the sustainability market by not innovating its BM (Aho, 2013; Zhao, Chen, Pan & Lu, 2017). An overhaul and redesign to better integrate a sustainability model and reflect value to society is desperately needed (Aho, 2013; Stubbs & Cocklin, 2008). Traditional models in the construction sector, based on cost, and neglecting value and performance, should be adjusted (Abuzeinab, Arif & Qadri, 2017; Mokhlesian & Holmén, 2012). Although sustainable practices in construction research focus on design strategies, tools and processes, this approach fails to identify the impact that BM transformation could have on conventional BMs, as well as successfully turning them into something that is sustainable and profitable (Aho, 2013). Traditional BMs are outdated and need to adjust to keep up with current demands.

Public awareness of environmental issues is growing and so is the demand for change. SDGs display the increased awareness of policy makers, the public and private businesses of the importance of sustainability practice (Moschetti, Brattebø, Skeie & Lien, 2018; United Nations, 2015). The construction industry is proven to be one of the top contributors to pollution (Horvath, 2004), while also utilising a large portion of natural resources, totalling 40% of total global use (Akadiri, Chinyio & Olomolaiye, 2012). Additionally, the housing sector contributes substantially to greenhouse gas emissions, waste, and environmental changes due to its activities and materials (UN Habitat, 2008). When companies decide to tackle these issues and are committed to SDGs, they must start by reviewing their current BMs (Bocken, Short, Rana & Evans, 2014; Hart, Milstein & Caggiano, 2003; Lüdeke-Freund, 2010; Roome & Louche, 2016; Schaltegger, Hansen & Lüdeke-Freund, 2016a; Stubbs & Cocklin, 2008; Wells, 2013). BMs need to be fluid and adaptable to the ever-changing business world (Birkin, 2009). Changing a BM and implementing these changes is a challenging and sometimes difficult process requiring investment (Abuzeinab et al., 2017; Aho, 2013; Magretta, 2002; Teece, 2010). Yet, research has suggested that BM adaptation and transformation is key to success (Chesbrough, 2010; Lüdeke-Freund, 2010; Schaltegger, Hansen & Lüdeke-Freund, 2016; Zott, Amit & Massa, 2011). As part of the investment program (HPDP, 2016; NTP, 2016), the Saudi Arabian government intends to invest money into housing policies, thus presenting an opportunity to upgrade the quality while also supporting the wider economic, environmental and social benefits that could be provided by a new SBM.

Due to the challenges associated with SP implementation, as mentioned previously, SHPs businesses currently only contribute to a small proportion of the housing market in both developed and developing countries. The industry to date has recorded a limited number of SHPs being built to meet verifiable sustainable performance standards (Hootman, 2013). In addition, the cost of sustainable investments in Saudi Arabia and globally currently remains very high. Limited literature is available linking SHPs to business cases and connecting economic, environmental and social sustainability to a BM and economic success and, thus, enabling modification to a SBM. Housing construction companies (HCCs) in Saudi Arabia have found it difficult to convert abstract sustainable strategies into viable and deliverable business concepts using existing operating practices and structures to create sustainable profits. This research proposes a SBMs framework to overcome these problems and enhance uptake of sustainability in the HCI.

1.1	**1.2**	**1.3**	**1.4**	**1.5**	**1.6**	**1.7**	**1.8**
Research Background	Research Gap and Justification for Research	Aim and Objectives of the Study	Research Methodology	Scope of the Study	Original Contributions	Thesis Structure	Summary

1.2 Research Gap and Justification for Research

Currently, many of the existing housing structures within Saudi Arabia lack quality and supply is failing to meet current demand (Al Surf, Trigunarsyah & Susilawati, 2013). Furthermore, in the Saudi market, much of the green building and SHPs available are costly (Al Surf et al., 2014); a consequence of flawed BMs. A challenge for many Saudi Arabian HCCs is the lack of BMs that include profitability and sustainable practices, which differ considerably from traditional approaches, meaning that simply adjusting the existing model would not be sufficient and other modifications are necessary.

Despite acknowledging that adaptation is necessary for a BM, there are limited guidelines or lack of collaboration on how best to incorporate sustainable practices into an existing BM (Bocken et al., 2014; Mokhlesian & Holmén, 2012; Shen, Li Hao, Tam & Yao, 2007). Sustainability is key to transforming the construction industry business (Warren-myers, 2016), and housing is a part of this relatively new phenomenon where research is needed. With guidelines and best practices agreed, sustainability business can reshape the HCI.

The HCI has a major impact on sustainable development, including social factors, economic growth and environmental issues (Abu Bakar, Abd Razak, Abdullah & Awang, 2009; Chiu, 2004; Wei Pan & Garmston, 2012; Xue, 2013). Attitudes across the globe have gradually shifted towards sustainable business practices, and companies adopting those practices are generally viewed as having a competitive advantage (Moschetti & Bratteb, 2016; Nidumolu, Prahalad & Rangaswami, 2009; Porter & Kramer, 2002; Schaltegger, Hansen & Lüdeke-Freund, 2016; Wasiluk, 2013). The housing construction industry lags behind and needs to adapt to meet this new demand (Igbalajobi, 2014; Myers, 2005). Innovation and adaptation are essential for the HCI.

While businesses are becoming more conscious of the environmental and social benefits of incorporating sustainability into their BMs, integrating the necessary changes to achieve sustainability can be challenging (Mokhlesian & Holmén, 2012; Zhao et al., 2017; Zhao, Pan & Lu, 2016). Industries such as construction, energy, real estate and mobility are increasingly under pressure from outside forces to address foundational sustainability matters (Loorbach & Wijsman, 2013; Nosratabadi et al., 2019). Lacking guidance or instruction, the HCCs are facing a major challenge in providing sustainable communities and buildings (Aho, 2013). Integration of improved sustainability practice is necessary for businesses to align themselves with societal change and market trends.

However, despite its identified importance, most research in the field of SBM for building and construction remains conceptual and offers a rather static view of a complex and dynamic reality. It does not address the necessary adaptation for current BMs to transform into sustainable practices (Aho, 2013; Igbalajobi, 2014; Mokhlesian & Holmén, 2012; Moschetti et al., 2018; Zhao et al., 2017). Subsequently, this research investigates ways in which HCCs can revise and transform their BMs to become having SBMs.

HCCs struggle to navigate implementation of sustainability principles and benefit from them economically at the same time. Modifying existing BMs triggers challenges and additional investment costs (Aho, 2013; Magretta, 2002; Teece, 2010), making this a costly transition.

By providing research to better assist the HCI to implement new ways to integrate sustainable practices into their business, will not only benefit industries, but also contribute to environmental and social gains (Schaltegger, Lüdeke-Freund & Hansen, 2011). The benefits of these objectives warrant urgent attention to encourage companies to successfully develop best practices.

This research will address this and will investigate how HCCs in Saudi Arabia can revise and transform their BMs to SBMs. Despite the issues discussed above, within BM thinking, the SBMs used by the HCCs have not been explored thoroughly, leaving their full potential unexplored. Consequently, by addressing this gap and investigating ways in which HCCs can revise and transform their BMs into sustainable models that contribute to SDGs, this research will make an original contribution to the existing body of knowledge in the respective subject area.

1.1	**1.2**	**1.3**	**1.4**	**1.5**	**1.6**	**1.7**	**1.8**
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1.3 Aim and Objectives of the Study

The aim of this research was established to answer the following research problem:

'How can HCCs incorporate fundamental changes in their BM based on sustainable value propositions to achieve SBM, therefore enhancing their economic performance?'

This central research question leads to several related theoretical and practical sub-questions as this research addresses both industrial and theoretical problems in the business of sustainability for the HCI. From this, the following four research questions are derived:

RQ1: What is a sustainable business model in the housing construction industry? And what are the changes in BM elements offering and processing when developing SBMs?

RQ2: What key challenges does an organisation face when creating and implementing SBMs?

RQ3: What key benefits will an organisation attain when implementing SBMs?

RQ4: How can SBMs be implemented and facilitated in the HCI?

While research questions one and two provide a theoretical background to SBM elements, changes and challenges, and address the research gap relating to ways in which organisations conceptualise and implement SBMs, research question three is designed to present the benefits of implementation. The last question is intentionally formulated to provide guidance for the implementation of SBMs in the HCI. Therefore, the research aim and objectives are presented below:

Aim: This research aims to develop a transition framework of sustainable business models for the Saudi Arabian housing construction industry. To fulfil the aim, the following research objectives have been set:

Objective 1: To critically review the current state of SHPs and support the business case for sustainability

Objective 2: To identify key challenges facing the implementation of SHPs that have already been identified in either developed or developing countries and link to economic success

Objective 3: To systematically review the emergence of sustainability in BM concepts for the housing and construction discipline and conceptualise the elements needed for the structure of SBMs

Objective 4: To define the SBM framework and identify anticipated changes, challenges and benefits associated with implementation

Objective 5: To propose and validate the framework of SBMs and guidelines for implementation in the HCI.

A summary of the research questions linked to the aim and objectives, and the research methods adopted are presented below in table 1-1:

Table 1-1 Research questions and relation to the objectives with the research methods

P Primary Method	S Supporting Method	Research Methods			
Objectives	**Research Questions**	**Literature Review**	**Semi-Structured Interviews**	**Focus Group 1**	**Focus Group 2**
To review the current state of SHPs and support the business case for sustainability	• What are the best practices for SHPs?	P			
To identify key challenges facing the implementation of SHPs that have already been identified in either developed or developing countries and link to economic success	• What are the major challenges globally and in Saudi Arabia facing the implementation? • How can economic success be linked with sustainability in the HCI through BM lens?	P			
To systematically review the emergence of sustainability in BM concepts for the housing and construction discipline and define, develop and conceptualise the elements needed for the structure of SBMs	• What is the BM definition and key elements from the business management industry and HCI more specifically? • How can the HCI revise and transform their business model into an SBM in order to contribute to sustainable development? What is the definition of the SBM and how is it presented?	P			
To define SBM framework, identify anticipated changes, challenges and benefits associated with the implementation	• How do professionals, from their perspectives, define and see the SBMs? • What are the key changes needed for the developed SBMs? • What are the key challenges and benefits associated with the implementation of SBMs?	S	P	P	
To propose and validate the framework of SBMs and guidelines for implementation in the HCI	• How do the SBMs elements interrelate and prioritise to facilitate implementation in the HCI? • How will the developed SBMs be implemented by the HCCs?	S	S	P	P

1.4 Research Methodology

This research is aimed at implementing SBMs in the Saudi Arabian housing construction industry. The research design of this empirical investigation is derived from the Saunders' 'Research Onion' model. Reflecting a philosophical stance, a subjective ontology and an interpretivist epistemological perspective, it suggests that it is impossible to coherently separate the researcher's value system from the object of the study. The communication and stakeholder interviews regarding the creation of SBMs using existing models in the HCI are extremely significant, offering further subject knowledge and understanding. Accordingly, the research is value-laden, adopting an axiological perspective, with an abduction approach. This study utilises multi-method qualitative methodologies to analyse the sustainability movement from a BM perspective and understand the economic complexity of sustainability. The first qualitative stage of the empirical investigation collects data by conducting in-depth, face-to-face interviews with a heterogeneous sample of twenty two professionals within three groups of stakeholders, as detailed in tables (5-4 and 5-5). The results provide the starting point for the second phase of data collection, which takes the form of two focus groups. The results of these investigations provide the basis from which to answer the research problem indicated above, while achieving the research objectives and the aim.

1.1	**1.2**	**1.3**	**1.4**	**1.5**	**1.6**	**1.7**	**1.8**
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1.5 Scope of the Study

The HCI has both a broad and narrow scope, as suggested by Clapham (2010). The narrow scope limits the view of the activities completed by the contractors and housing developers, while the broad scope suggests including stakeholders and the wholesale and supply chain from the housing construction industry. The broad scope has the potential to help in formulating the link between economic and sustainable activities that, in turn, directly depend on the narrower scope, which focusses on contractors. Both scopes complement each other in producing the data for this research.

The developed SBM will aim to provide solutions for supporting the HCI and build a real case for conducting business with sustainability objectives in the new open market, helping to ensure sustainability in the Saudi Arabian HCI. Furthermore, this research will consider business management factors that can be controlled internally by organisations or companies, and external factors known to relate to the market. It is impractical to encompass all the features of the industry in a single study. Hence, the following points highlight the scope of this research:

- A new SBM can be useful at different levels, such as the research and development R&D unit, HCCs and the industry as a whole (Wirtz, 2011). This research will focus on the BM at company level.
- The study will conduct interviews with Saudi HCI stakeholders, including housing construction company practitioners in top management, as they have better understanding of BM thinking. Companies will be selected based upon the size and complexity of ongoing housing projects and will include specialists in the fields, such as consultants, architects, project managers and engineers.
- To cover the external factors for the SBM, the research will include participants from the housing ministry and other agencies associated with sustainable development implementation in the country. All participants interviewed are chosen from firms classified as top, using the category of housing in Saudi Arabia (determined according to the Ministry of Housing classification, MOH, 2014). Using this heterogeneous sampling will help ensure common ground regarding the SBMs and simplify understanding of their attributes at industry level.
- This study is built upon empirical data from stakeholders in the Saudi HCI, including practitioners, agency leaders, consultants and professionals; thus, its findings may be limited in that only the Saudi context and circumstances are reflected. However, the interpretations that will be discussed may be transferable elsewhere with careful consideration and adjustment.

- The term 'sustainability' is often misinterpreted, as many neglects to encompass its full range of considerations. In some cases, only environmental aspects are concerned, while social and economic considerations are ignored. This study will cover the three aspects of sustainability; environment, society and economy, when they are part of a collective sustainable value proposition. Participants who show no knowledge about the concerned topic will be excluded from the study.

1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8
Research Background	Research Gap and Justification	Aim and Objectives	Research Methodology	Scope of the Study	Original Contributions	Thesis Structure	Summary

1.6 Original contributions

The unique and original findings of this research, as summarised below, contribute to the body of knowledge and practice of SBM in HCI:

1. It justifies the relevance of linking BMs with sustainability practices in the HCI for economic benefits using a systematic approach.
2. It records systematically the emergence of SBM definition in the HCI.
3. It explores, propose and adapt SBMs in the Saudi HCI context.
4. It presents in-depth understanding of key changes in existing BMs associated with SBM transformation.
5. It identifies key challenges associated with SBM implementation and how it extends to present benefits.
6. It maps the relationship between SBM elements, generating the relationship between the challenges associated with SBMs to highlight the source of challenges.
7. It introduces implementation guidelines that can facilitate the HCI's top management mission in transforming to SBMs.

1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8
Research Background	Research Gap and Justification	Aim and Objectives	Research Methodology	Scope of the Study	Original Contributions	Thesis Structure	Summary

1.7 Thesis Structure

The structure of this research is categorised into seven chapters – as illustrated chronologically in figure 1-1 – starting with Phase 1, which is the research introduction, then Phase 2, which shapes the SBM theoretical foundation and perspective, Phase 3, which demonstrates the methodology used for the research, and Phase 4, which forms the empirical data and analysis of SBMs and expands the theoretical findings to a practical guideline for top management. Finally, a conclusion, recommendation, and future research direction are provided in Phase 5.

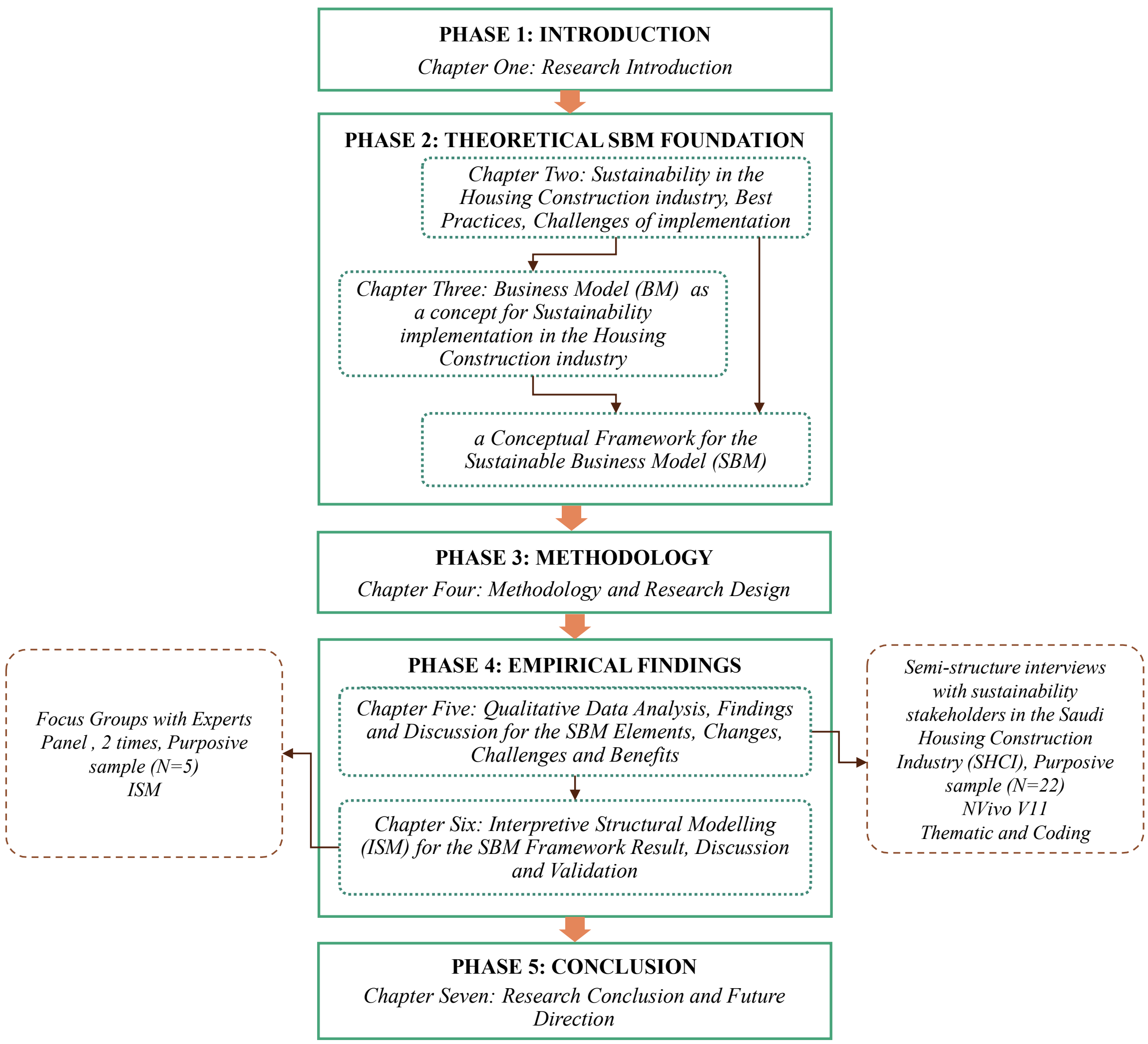

Fig 1-1: Research Process

Following this introduction, the thesis is organised as follows (Figure 1-1): **Phase 1** covers research background and contexts, motivation and gap, research questions and aim, summary of the methodology, original contributions and structure of the research.

Phase 2 constructs the theoretical basis for the SBM, which is divided into two chapters. **Chapter 2** analytically reviews Sustainable Housing Practices (SHPs) to reach definitions and system boundary. Multiple approaches have been employed, starting with a series of terms sharing similar meanings in the literature on SHPs, which include: Low Carbon Housing, Near-Zero Carbon Housing, Energy Efficient Housing, House On-Site Grey Water Treatment, Prefabricated SH/Off-Site Construction House, Smart Home, 3D Printing House, and Social Sustainable Housing. The focus is on the environmental, economic, and social perspectives of SHPs for the development of the SBMs. Another approach is to discuss the challenges behind the slow uptake of SHPs, both internationally and in the Saudi Arabia context. The advantages are briefly deliberated and the response of the HCI to the sustainability movement is offered in order to identify drivers and opportunities.

Chapter 3 reviews the BM concept from varied disciplines, such as business management, construction management, building structures, and housing construction, to identify elements of a BM and draw a conclusion from the literature relating to the definition and the use of the BM in the field of HCI. To justify and highlight use of the SBM approach for the HCI, a further focus of this analysis is the emergence of the SBM in the building and construction disciplines. The link between sustainability and BM is introduced in the last part as a conceptual SBM framework.

Phase 3 in **Chapter 4** discusses the methodology used for this research. This chapter discusses and justifies the methods adopted to implement and validate the SBMs framework within the Saudi Arabian context. Research philosophical stances, research models, approaches, strategies, and data collection methods are provided and discussed. Semi-structured interviews and focus groups are the main instrument of data collection. Moreover, purposive and suitable sampling is used to ensure selection of a representative sample. Combined data analysis techniques are employed to overcome limitations, including thematic analysis and Interpretive Structural Modelling (ISM).

Phase 4 starts in **Chapter 5**, which presents the data analysis and research findings. The context of the data will be discussed, presenting the participant profile and interview process. Thematic analysis is used to interpret the interview findings. The findings are arranged into six main themes: presenting the SBM definition, elements of the framework, changes, benefits of SBM use in HCI, as well as challenges associated with implementation. Sub-themes emerging from the data analysis are included.

Chapter 6 utilises the ISM-based model with a focus group consisting of five experts to examine the relationship and priorities of the SBM elements and to understand the common effects of SBM challenges. The ISM technique is utilised for both the SBM framework elements and the challenges, respectively. Finally, a discussion presenting the research findings, as well as guidelines for SBM implementations will be presented

Chapter 7 includes Phase 5, which concludes with a summary of the research findings, contributions, recommendations, and potential for future research paths.

1.1	**1.2**	**1.3**	**1.4**	**1.5**	**1.6**	**1.7**	**1.8**
Research Background	Research Gap and Justification	Aim and Objectives of the Study	Research Methodology	Scope of the Study	Original Contributions	Thesis Structure	Summary

1.8 Summary

This research is structured into seven chapters. This chapter summarises the research background and the contexts of the development of SBMs framework in the HCI. The research problem is stated, and justifications are discussed. The aims and objectives of the study are highlighted. Research methodology used for the empirical investigation is explained and justified as the appropriate tool for enhancing this study. It concludes with the original contributions being offered and sets up the structure of the study. The following chapter will begin to theoretically construct the basis for the SBM by reviewing the SPs in the HCI.

Chapter 2

Sustainability in the Housing Construction Industry: Literature Review

Sections

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Chapter 2. Sustainability in the Housing Construction Industry: Literature Review

2.1 Introduction

As previously mentioned, sustainability in the housing practices creates the fundamental research domain that relevant to the SBMs framework development. Thus, it is important to start with highlighting the best practices and the issues related to sustainability practices. The current chapter begins by discussing the origins of sustainability and its agenda relative to the HCI globally and in Saudi Arabia more specifically, including the three main pillars: economic, environmental and social factors. As there is a limited number of SHPs in the Saudi Arabian housing market, the chapter identifies key practices and draws system boundaries associated with sustainability application in the HCI by reviewing best practices globally and utilising best calculation metrics for the benefit of identifying best performance practices. Additionally, it demonstrates the difficulties involved in implementing sustainability practices by examining the fundamental challenges inherent in the development process, using a PESTEL analytical framework to build a sustainable business model and business case for sustainability. Therefore, the last section presents SHPs agenda and key challenges in Saudi Arabia using a similar approach.

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2.2 Sustainable Development Agenda

The term sustainability has received significant levels of attention in recent years. For anything to be sustainable, it needs to be maintained at a certain level or rate (Hopwood, Mellor, & O'Brien, 2005). There are several definitions of sustainability, but the scientific definition and precise measurements offered are not widely accepted among all researchers, which renders them inherently vague (Knudstrup, Ring Hansen & Brunsgaard, 2009; Morgan et al., 2014; Seyfang, 2010; Stojkoska & Trivodaliev, 2017). The Brundtland Report (1987) defined Sustainable Development (SD) as ‘development that meets the needs of the present without compromising the ability of future generations to meet their own needs’ (World Commission on Environment and Development, 1987). Complementary to the previous definition is that offered by the International Union for the Conservation of Nature (IUCN), the United Nations Environmental Programme (UNEP), and the World Wildlife Fund (WWF) (1991), according to whom SD is ‘a development which improves people’s quality of life, within the carrying capacity of earth’s life support systems’ (p.17). In the first definition, the necessity for solidarity and responsibility spans generations, while in the second definition, the social and environmental dimension is highlighted as vital elements of sustainability.

Adoption of SDGs initiatives and practices requires the conception and implementation of certain sustainability frameworks for the built environment. As a structured environment, the part of the environment constructed or organised by people, including infrastructure and buildings, is defined. When comparing the industry of building and construction with other industrial, its superiority in terms of size and its interconnectedness with many diverse activities highlights its extreme importance to the whole society. Alongside this, population growth requires the construction of buildings and modern infrastructures. The construction of building facilities, transportation networks, communication networks, and water and sewage networks is the cornerstone of proper economic and social development within a country, and relates directly to the achievement of sustainability worldwide (Al-Shaalan, Ahmed & Alohaly, 2014). Therefore, SD is an act of balancing the fulfilment needs of people, while protecting the natural environment and ensuring the current generation does not deplete resources that will be required by future generations.

2.3 Sustainability Agenda in the Housing Construction Industry

According to Mitlin and Satterthwaite (1996), the designation SHP can be applied to a shelter that is healthy, safe and affordable, with access to full amenities, including healthcare, education, transport and child development opportunities. Whilst meeting all social and cultural priorities, SHPs must also provide protection from environmental hazards and pollutants (Mitlin & Satterthwaite, 1996). In the above definition, traditional views regarding how best to create structures is apparent, but De Feraudy (2014) and Morgan et al. (2014) also focus on the social and environmental aspects of sustainability, stating that consumption of resources should take place in a sustainable way and that any new building should blend into the social and cultural fabric. Thus, preconceived ideas of housing construction; i.e., planning, designing, building and selling, hold no validity in the urban landscape (Morgan et al., 2014). In another definition of SHPs, the quality of construction, social and economic factors, like affordability and psychological impacts, and use of resources, define the level of SHPs (Tukker, 2005). Thus, efficiency at every stage of a housing development contributes to the overall quality of that development, whether in terms of build, environmental responsibility, or social cohesion.

Golubchikov and Badyina (2012) express a modern view of SHPs, stating:

"SHPs are residential environments that (a) are healthy, durable, safe and secure; (b) are affordable for a wide array of income-groups; (c) use natural and readily available building materials and technology; (d) can withstand potential natural disasters and climatic changes; (e) are connected to a decent and safe energy and water source, including sanitation and recycling facilities; (f) use energy and water supplies most efficiently and have provision for on-site renewable energy generation as well as water recycling capabilities; (g) should not pollute the environment yet should be protected from external pollutants; (h) are connected to jobs, shops, healthcare, and education-related services; (i) integrate and enhance the social, cultural and economic fabric of the community and urban areas; (j) are properly run and given timely maintenance, retrofitting and renovation (2012, p. 9)."

SHPs are achieved through efficient use of resources and energy during the design of the housing, during the construction phase and in the operation of the development, protecting the occupants' health from housing-related threats, and protecting the environment from pollution arising from greenhouse gas emissions from houses and other forms of environmental damage.

2.3.1 Sustainable Housing Best Practices

Research into the SHPs agenda in this subsection is carried out using a combination of a comprehensive review of the literature for better performances studies and practices, which plays a significant role in achieving sustainability in the HCI internationally, and researches and peer review articles with high citation ranking during the last 10 years. The studies are selected using a purposive sampling principle (Bryman, 2008) to cover as many dimensions and aspects as possible for comparison, and to increase information accessibility for the development of the business case for sustainability and SBM table (2-1). The studies highlighted include twelve pioneering SHPs from around the world, including: Low Carbon Housing (Knudstrup et al., 2009; Seyfang, 2010), Near-Zero Carbon Housing (Morgan et al., 2014), Energy Efficient Housing (Banfill & Peacock, 2007b; Leckner & Zmeureanu, 2011), House On-Site Grey Water Treatment (Fountoulakis, Markakis, Petousi & Manios, 2016), Prefabricated SH/Off-Site Construction House (Luther, 2009; Marjaba & Chidiac, 2016), Smart Home (Stojkoska & Trivodaliev, 2017), 3D Printing House (Hager, Golonka, & Putanowicz, 2016), and Social Sustainable Housing (De Feraudy, 2014). The focus in this section is on the environmental, economic, and social perspectives of the SHPs, using a number of strategies designed to support the uptake, and presenting the advantages of the accomplishment. The aim of section 2.3 is to highlight factors, business opportunities and possible achievements, and potential benefits for successful achievement of SHPs.

2.3.2 Net Zero Carbon and Low Carbon Emission Housing

Near zero carbon housing, in which houses are designed to function with near zero carbon emissions through a combination of onsite electricity generation, standard ventilation, and cooling systems that are sufficiently energy efficient to eliminate the need for carbon generating space heating. This approach, which has been applied in the United Kingdom (UK), has proven to be of potential value, both for injecting alternative sources of energy and for recovering lost energy, resulting in a 70% reduction in carbon dioxide emissions

(Banfill & Peacock, 2007). A study by Seyfang (2010) focusses on community action for SHPs, with emphasis on a low carbon future. Community action involves localising construction, inclusivity and empowerment, reduction and recycling of materials, water conservation using rainwater catchment, as well as enabling self-build and self-support.

Low carbon is managed through effective energy efficiency, using cheaply available local materials, and public participation using social capital. With this strategic green niche community-based innovation, UK practices are moving towards reducing carbon dioxide emissions by 80% in the next 20 years (Department of Energy and Climate Change, 2008). Similarly, a low carbon emission housing idea has been applied in Denmark, focussing on reduction of energy use, especially carbon-based heating sources. In Denmark, low carbon housing has been achieved through passive design principles; i.e., preservation and increments in biodiversity, thermal efficiency and home insulation, thus ensuring efficient energy use and, where possible, use of renewables.

SHPs have resulted in biodiversity, renewable energy exploration, methods for reducing energy loss from houses, reduced transportation needs, and electrical power utilisation. This strategy has reduced energy requirements for household heating systems by 50%, using a low energy consumption housing envelope with maximum insulation (Knudstrup et al., 2009). For an example of good SHPs and the challenges addressed to reach those conclusions, see table 2-1.

2.3.3 Net Near Zero Energy Housing

The zero-energy house practice is an applicable idea that has been on the market for a while. For example, Korsgaard directed a study on the idea in Denmark in 1977. During the last few years, researchers and developers have established frameworks for the idea and many countries now are supporting its implementation. Some have already implemented it as an experimental/prestige case, while others are working on its viability (Twinn, 2012). Using a similar approach to energy efficient housing in Canada's cold weather cities, Leckner and Zmeureanu (2011) achieved net zero energy housing, using an efficient solar combine system, able to generate more energy than required, or energy storage equal to the requirement of a cold weather Canadian housing unit. Their idea focussed on efficient design in relation to energy utilisation, waste management, renewability of systems, and maintenance of health and wellbeing. Net zero energy has so far achieved an energy payback time in the range of 8-11 years, with a ratio in return in investment reaching 3.6 to 4.8 (Leckner & Zmeureanu, 2011). This, respectively, identifies opportunities, but the number of challenges, such as different weather conditions and energy costs in the country, made the financial opportunities difficult to achieve.

2.3.4 On Site Water Treatment and Grey Water Use House

Another model of efficient house considered uses onsite grey water waste recycling and reuse, utilising a submerged membrane bioreactor treatment facility. The model for the house prioritises efficiency in terms of water usage, thereby reducing pollution and consequently maintaining good health and well-being by increasing the availability of clean water. Using this model, Greece has reduced water consumption by 80% (Fountoulakis et al., 2016). A study in Australia used onsite water treatment using grey water system, reducing anionic surfactants resulting in an 80% saving approximately. This study shows the challenge of long payback times, equal to 15 years for single households (Jabornig, 2014). Another challenge appears in the same study relating to the low cost of fresh water and sewage disposal, which makes investment in the business case difficult to achieve.

2.3.5 Prefabricated and Off-Site Housing Construction Units:

Luther (2009) reported a further environmentally-friendly housing construction practice; this model relies on prefabricated architectural building materials capable of delivering high quality urban modern housing with a predetermine design. Prefabricated housing uses automated materials with faster delivery and prototyping, finally resulting in effective waste management, reduced environmental impact, integrated renewable energy, and maximisation of material usability. In Australia, alternative prefabricated housing is known for shortening construction times, and consequently has reduced the cost of operational energy by 50% (Luther, 2009).

2.3.6 Smart High Efficient House

Risteska et al. (2017), reporting on the Internet of Things (IoT), model the idea of the smart house that combines energy and water efficiency and which effectively manages pollution. Based on the SHP agenda, this model, as a solution, uses less energy and materials, employs an intelligent power schedule, has high design capabilities and provides cost effective solutions. This study presents a holistic approach to the use of IoT in the HCI and offers a new operation for managing the house. The study highlights challenges such as data processing, networking, and interoperability, along with other challenges.

2.3.7 Social Sustainable Housing

Sustainability has also been applied to social housing initiatives through effective design, efficient energy and water usage, social inclusion through empowerment, and public participation to ensure safety and quality of life. According to Feraudy (2014), a pilot project for a social housing initiative in Brazil, Thailand, India and Bangladesh achieved thermal comfort, and incorporated solutions in alternative design for maximum safety, affordability, accessibility, and collective wellbeing. The study aimed to overcome challenges by raising awareness, training workers and supporting the supply chain to increase the demand.

2.3.8 3D Printing House

Similar parameters reported in the Netherlands and China are claimed to have enhanced production speeds by 300% using 3D printing of full residential buildings and building units (Hager et al., 2016). This model, as opposed to traditional methods of construction, could be considered an environmentally-friendly practice, with almost unlimited options for geometric complexity in housing unit applications. The study highlights new challenges facing such technology, new capacity building for architects and designers, as well as the lack of new and innovative building materials.

Table 2-1: Major SHPs in the Housing Construction Industry (2007-2016)

Author Year	Housing Idea, Location	SHD Perspective	Factors	Achievements Based on SHD Strategy	Benefits
- **(Banfill & Peacock, 2007)**	- Energy Efficient Housing - UK	- Environmental - (Zero-carbon home using a range of on-site power generation).	- Energy Efficiency - Renewable System - Ventilation - Electricity Storage - Materials - Pollution - Health & Wellbeing - Air quality - Design - Life cycle	- Reduction of total emissions should address both new build and existing housing using technological potentials such as wind turbine and organic solar PVs - Alternatives sources of energy. - Use technology to reduce the energy bill by recovering heat from the ventilation air, such as mechanical ventilation	- 70% reduction in carbon dioxide emission through technology that avoids much normal heating using organic PV cells much cheaper
- **(Knudstrup et al., 2009)**	- Low CO2 Emission Housing - Denmark	- Environmental and Political (Reducing energy uses using passive house idea)	- Passive Design Principles - Preserve or increase biodiversity - Life cycle assessment of materials applied in the building - Transportation - Thermal mass of materials - Insulation of Housing envelope - Zoning - Mobility of building - Ventilation - Renewable energy source - Energy producing elements - Energy efficient - Embodied energy of resources	- Achieving biodiversity (gardening and vegetation) - Renewable energy sources through the housing shape to reduce energy - Reduction of energy loss through the building envelope (insulation, window area to orientation ratio, window to floor area ratio, surface to floor area ratio, zoning, thermal mass, mechanical ventilation) - Decrease of electrical power (utilisation of daylight, physical ventilation and energy efficient appliances) - Reduce private transportation	- 50% reduction in energy used in heating system. - Insulation of the housing envelope resulted in very low energy consumption - Calculation of energy requirement relative to an energy frame and using PVs
(Luther, 2009)	- Prefabricated SH - Australia	- Environmental and Social	- Automated manufacturing - Waste - Renewable System - Optimal performance - Automated manufacturing - Health & Wellbeing - Pollution - Materials - Affordability - Fast delivering - Prototyping	- Waste management - 3 Rs (reduce, reuse, recover) water in the production. - Maximising usability of materials to curb wastage - High material optimisation through components reproduction - Low energy bill - Improve IEQ - Integrated renewable energy systems - Superior fire protection - Increased guarantees - Reduced Environmental impact - Speed of assembly - Increased production	- 20-25% cost reduction using prefabricated as opposed to expensive special fabrication - Reducing operational energy by shortening construction time
- **(Seyfang, 2010)**	- Low Carbon Housing - UK	- Environmental and Social - (Achieve sustainable consumption, based on new	- Energy Efficiency - Water Efficiency - Materials - Waste - Quality of life - Design	- Localising the construction supply - Reduced ecological impacts - Community- building - Recycled materials	- 80% reduction in carbon dioxide emission through strategic green

		economic indicators) -	- Social Capital - Sense of community - Employment - Accessibility (local services, facility, green space, etc.) - Community - Public participation -	- Communally inclusive and empowering construction techniques - Reducing materials throughput both in building and inhabitation of the dwellings - Enabling self-build - Self-support from majority utility services - Water conservation using rainwater harvesting.	niche community-based innovation
- (Leckner & Zmeureanu, 2011)	- Net zero energy House - Canada	- Economic and Environmental - (energy efficient house uses existing solar technologies to produce as much energy as the home uses)	- Energy Efficiency - Materials - Waste - Pollution - Design - Life cycle - Ventilation - Renewable System - Maintenance - Health & Wellbeing	- Quick payback time - Using life cycle cost analysis - Using life cycle energy use - Solar energy combisystem - Photovoltaic energy - Acceptance from the customers	- Quick energy payback time of 8-11 years - High payback ratio of 3.6-4.8
- (Morgan et al., 2014)	- Sustainable Home	- Environmental Social Economic - Political	- Energy Efficiency - Materials - Waste - Health & Wellbeing - Design - Life cycle - Ventilation - Social Inclusion (feel valuable) - Social Capital - Accessibility (local services, facility, green space, etc.) - Community - Renewable System - Affordability - Maintenance	- Achieving energy efficiency and zero carbon will cost between 2.5 to 12.9% per dwelling on site, but offsetting with 'Allowable Solutions' will decrease this cost - Increasing land supply by 20% - choosing perfect land will reduce until 40% of the total price	Not Specified
- (De Feraudy, 2014)	- Sustainable Social Housing Initiative (SUSHI)	- Social - Environmental	- Design - Materials - Technology - Climate adaptation - Energy Efficiency - Water Efficiency - Quality of life - Training - Social Inclusion (feel valuable) - Social Capital - Safety - Sense of community - Employment - Accessibility (local services, facility, green space, etc.) - Community - Public participation - Affordability	- Including provision of thermal comfort - Water supply and consumption - alternative design solutions - solar water heater - Providing strategies for developers to incorporate sustainable solutions in the design, construction and operation of social housing units - Supports individual and collective well-being - Design maximise the community within the neighbourhood and opportunities for residents to get involved - Create feelings of safety for residents - Identify financing opportunities and strategy	Not Specified
- (Fountoulakis et al., 2016)	- House On-Site Grey Water Treatment	- Environmental - (using bioreactor water treatment).	- Water Efficiency - Waste - Pollution - Health & Wellbeing	- Increase water availability	- 80%decrease of waste by treating used water using

	- Greece		- Life cycle		bioreactor water treatment
- (Marjaba & Chidiac, 2016)	- Off-Site Construction House (OSC) - World-Wide	- Environmental	- Quality of life - Health & Wellbeing - Materials - Affordability - Waste - Fast delivery - Life cycle LCA - Prototyping	- lower impact at construction site - increase workers' safety - reduced waste generation - improved quality - Reduction in transportation - Noise - Site disruption	- Waste reduction to less than 5% in a factory environment with greater potential for recycling - lean construction of modular homes reduce waste by 64% and reduces production time by 31%
- (Stojkoska & Trivodaliev, 2017)	- Internet of Things (IOT) - Smart Home - World-Wide	- Environmental Technological	- Smart Grid - Energy Efficiency - Water Efficiency - Waste - Pollution - Health & Wellbeing - Quality of life - Design - Ventilation - Safety - Renewable System	- Renewable energy sources, such as wind and solar systems, biomass, fuel cells, and tidal power thus they would be able to buy/sell energy - Intelligent power scheduling - Succeed in providing predictions of indoor temperature - Cloud households' data - Environmental Sensor for comfort and energy efficiency, safety such as in appliances, floor, lighting etc. - Economical dwelling	Not Specified
- (Hager et al., 2016)	- 3D-Printing House - China - Netherlands	- Environmental Technological Economic	- Energy Efficiency - Materials - Waste - Pollution - Health & Wellbeing - Quality of life - Design - Life cycle - Transportation - Social Inclusion (feel valuable) - Safety - Employment - Renewable System - Automated manufacturing - Repeatable - Affordable - Workers safety	- Flexible design - Low cost house - Excellent heating and cooling insulation - Reduce energy, waste, money and time - Attractive and interesting designs as 3D printing - Increase production speed - Low cost transportation - Workers' safety - Lower cost construction - Using recycled materials - Decrease injuries and fatalities onsite as the printers will do most hazardous and dangerous works - Less material waste and dust - Time saving - Lower labour costs	- Enhance production speed by 300% - Environmentally friendly - Reduced number of injuries and fatalities onsite - Wet construction processes are minimised - The cost of printing construction elements of houses is much lower than traditional construction methods - Time saving

In summary, the implementation of SHPs presents many benefits, as shown in the table above (2-1). The construction business can incorporate sustainability in the housing sector into their long-term practice business model and enhance economic and business case performance and social and environmental benefits. To test this research question, the next subsection, 2.4, will use the Political, Economic, Social, Technical, Environmental, Legal (PESTEL) framework to assess how SHPs could be beneficial in three areas; namely, Environment, Economics/Profitability, and the wider Society (EES). This section is the first stage on the way to developing a business case for sustainability in the HCI and assessing the new housing market; the PESTEL analysis will evaluate the challenges that face SHPs. Understanding any challenge at the start of the process will be crucial for creating robust SBMs that will cover the entire lifecycle of the SHPs and associated infrastructure. The study in this phase is based upon a literature review and exploration of notable articles within the context of the PESTEL analysis.

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2.4 Challenges of Sustainable Housing Practices' SHPs – PESTEL Analysis

In recent years, the idea of implementing sustainability in housing construction has become more popular (Marjaba & Chidiac, 2016). There has been a gradual shift towards designing homes with reduced environmental and social impacts, including better use of resources during construction and over the lifecycle of the buildings. However, support for SHPs has been sporadic, and practices have not transferred from small projects to wholesale adoption by the traditionally conservative construction industry (Cherry, Hopfe, MacGillivray & Pidgeon, 2017; Seyfang, 2010). In addition, high upfront costs further decelerate the uptake, so a new approach is required. This takes the form of creation of an entire SBMs framework with its own value chain, promoting SHPs as viable alternatives. Accordingly, this section reviews SHPs literature to understand the challenges and benefits of building robust and workable SBMs.

The analysis investigates the implementation challenges when adopting SHPs into business model thinking and assesses how it would be possible to include principles of sustainability while remaining profitable. Overall, any implementation of sustainability agenda in housing construction should minimise the environmental footprint by using fewer resources during construction and upkeep, thereby creating less environmental damage (Marjaba & Chidiac, 2016). SHPs should have a minimal impact on the environment and on the wellbeing of society. At present, many SHPs are created by individuals seeking to support the environment, and it is important to translate this concept to a wider business model that will engage the public and create a larger market (Seyfang, 2010). Review of the literature found that there are, at present, few studies discussing the BM thinking for SHPs and no appearance of the idea of SBM in the HCI literature. This section will form the first stage in rectifying this gap in the sustainable business management literature, by identifying potential challenges to establishment of a SBM framework, laying the groundwork for identification of workable solutions.

In summary, the present SHPs polices often focus on small developments, and this does little to promote cooperation between stakeholders or create new supply chains that capture value at every stage. Changing to a broader SBMs will create a more amenable environment for the building of sustainable developments and bring greater consistency to the process. Using a PESTEL analysis, this study will look at sustainable business models across a range of factors and scales to highlight the challenges.

2.4.1 PESTEL Analytical Framework

The main reason for using the PESTEL analytical framework rather than other methodologies, such as SWOT, is that PESTEL covers many of the wider factors affecting SHPs. Broadly thinking, these factors describe the impact on the economy, environment, and society, and operate on several levels and scales. While the HCI affects the local environment and also the global environment through CO_2 emissions, local planning laws can have as much influence as international laws (Issa, Chang & Issa, 2010). PESTEL can incorporate all of these and show how they can shape a business and help to increase the uptake of SHPs.

Another reason for using PESTEL is that most SHPs studies and policies have focussed on architecture, politics, technology and the environment. While these are crucial, they ignore the social and economic consequences that shape the long-term planning required.

Accordingly, the PESTEL methodology’s six categories cover most of these important aspects and address a wider context in detail. The study will show how SHPs fit into the web of complex and interconnected links between business and SHPs, including political, economic, societal and cultural norms, environmental and legislative.

Finally, PESTEL is a strategic tool considered particularly effective for analysing how external contexts and factors can affect businesses and policies. It builds upon the normal PEST analysis, which includes political, economic, social and technological factors, and adds legal and environmental issues. These two factors are very important steps for SHPs. The discussion will follow the structure laid out in the PESTEL analysis, and will include the six factors mentioned above, which will be described in more detail in the relevant subsections. Table (2-2) presents the major challenges based on the PESTEL analytical framework, and highlights some of the relevant literature describing them.

Table 2-2: Key Challenges for SHPs from international practices

PESTEL Categorises	Key challenges	(Banfill & Peacock, 2007b)	(Luther, 2009)	(Knudstrup et al., 2009)	(Pickvance, 2009)	(Seyfang, 2010)	(Leckner & Zmeureanu, 2011)	(Mokhlesian & Holmén, 2012)	(Akadiri et al., 2012)	(Morgan et al., 2014)	(De Feraudy, 2014)	(Oyedele, Ajayi, & Kadiri, 2014)	(Fountoulakis et al., 2016)	(Mariaba & Chidiac, 2016)	(Hager et al., 2016)	(Stojkoska & Trivodaliev, 2017)	(Chan & Adabre, 2019)
Political	lack of a clear and consistent definition for SHPs			√	√	√				√	√			√		√	
	Few policies addressing SHPs within the context of climate change	√				√							√	√			
	Inadequate government support					√				√							
	Low futuristic planning				√					√							
	Legislative silos due to a lack of interconnection between government departments and the private sector				√							√					
	Little consideration of SHPs when negotiating governmental procurement and contracts							√		√							
Economic	High upfront and initial costs	√	√	√			√			√	√		√	√	√	√	
	Affordability																√
	Lack of financial incentives and grants	√			√	√				√							
	Limited demand risk for early adopters	√	√	√	√	√				√	√		√		√	√	
	Long-term payback on investment (not convincible)	√					√						√				√
	The business model does not reflect savings	√					√			√				√			
	Slow industry							√		√							

	Cost-based industry						√										
	High land cost and low availability									√							
	Low profits									√							
Social	Lack of awareness of sustainability (public, developer, government)					√								√			
	Customer behaviours	√			√	√			√	√	√		√				
	Hard to achieve the privacy concept															√	
	Hard to ensure security								√							√	√
	Acceptance, interest, beliefs					√					√	√		√	√		
	Integration with stakeholders	√															
Technological	Shortage in practice					√	√			√	√		√	√	√	√	
	Skills shortage	√				√	√			√	√	√	√	√			
	Shortage of training					√				√	√			√			
	Innovation is slowly developed			√					√	√							
	Adaptability and flexible design		√	√					√	√			√				√
	Lack of closed-loop production		√	√		√	√										
	Data processing and memory		√													√	
	Materials innovation					√						√			√		
	Lack of experts		√	√		√	√			√		√				√	
	Limitation of mature green/sustainable and effective supply chain	√	√			√	√	√	√	√				√		√	
	Lack of information		√							√			√		√		
	Difficult to exchange knowledge and cooperate with the more traditional practitioners and clients					√											
	Lack of low cost/scalable technology		√												√		√
	Lack of local materials or Single Supplier for Materials	√			√					√				√	√		
Environmental	Climate change			√						√							
	Lack of renewable source of energy and water	√														√	
	Hard to insure prevention from pollution				√									√			√
	Land location			√	√	√				√	√						
	High waste industry				√				√					√			
Legal	Response to climate change is not mandatory		√		√	√	√										
	Weakness of definitive regulations		√			√	√			√	√		√				
	Inadequate national sustainability rating system									√				√		√	

Full implementation of SHPs is subject to many major challenges, all of which require economic growth to be present in society to allow effective utilisation of raw materials and energy. The chief barriers to SHP implementation are; economic, technological, social, political, environmental and legal, with each bringing its own set of challenges. Importantly, rather than trying to overcome these challenges individually, the SBMs framework will encourage a holistic approach that encourages all stakeholders to develop common solutions. The framework will move the SHPs process from a niche-driven endeavour to a multifaceted business approach that uses policies, regulations and standards to shift thinking from purely environmental to social and economic. Discussion of the major challenges presented next.

2.4.2 Political Challenges

As with many areas of building and construction, politics plays a major role in supporting any sustainable development, whether on large or small scales. Without consensus and support at all levels of the political hierarchy, planners, designers and developers lack the guidance and impetus to make the necessary changes. In addition, when creating broad approaches that bring together many stakeholders, often across international borders, only higher political levels have the ability to draw the different actors together and create usable frameworks. However, political challenges – such as politics can be partisan and subject to lobbying, lack of expertise to understand sustainability – appeared in the studied literature (Cherry et al., 2017; Choguill, 2007). Different departments and different layers of government become involved; they may follow their own ideas and face difficulties in coordinating (Pickvance, 2009). Governments provide incentives, but they can also create disincentives, so policies can facilitate or hinder sustainability implementation (Seyfang, 2010). Other challenges – such as lack of a clear definition for sustainability in HCI, limited availability of policies addressing SHPs, legislative silos due to a lack of interconnection between government departments and private sectors, little consideration of SHPs when negotiating governmental procurement and contracts – appeared as the main issues facing the business of sustainability in the HCI. Overall, this factor assesses how organisations and governments intervene in economies, and it includes policies covering physical infrastructure and intangible infrastructure. Some of the more important issues described in the literature include:

- **Lack of a clear and consistent definition for SHPs**

Although the concept of sustainability in the HCI is reasonably well defined in academic literature on SHPs, there is a lack of clarity within politics, business practices, media and the public (Cherry et al., 2017). In turn, there is no consistent definition, which is essential for guiding policies and legislation (Marjaba & Chidiac, 2016). As a basis for any business, a workable definition is required that encompasses politics, academia and business to ensure everyone is speaking the same language.

Sustainability in a building should be quantifiable and use metrics that support policymaking, including economic and social benefits alongside the well-publicised environmental advantages (Marjaba & Chidiac, 2016). For example, although the commonly cited Brundtland Report defines SD, many architects regard the definition as too broad. Instead, architects refer to projects as ‘low energy,’ or ‘green,’ so a project emphasising ‘nature’ could focus on biodiversity and renewable energy sources, while ‘zero carbon’ might focus on energy efficiency technology (Knudstrup et al., 2009). These narrow terms are more common in SHPs literature.

For a sustainable business, definitions focussing on the environment can be misleading and encourage policymakers to focus on eco-housing, assuming that the others fall into place (Marjaba & Chidiac, 2016). The business case for sustainability should recognise the importance of integrating socioeconomics into policy and establishing their place in the value chain. Lack of definition is one of the reasons why most jurisdictions lack definitive polices for SHPs, so it is a crucial part of the process.

- **Few policies addressing SHPs within the context of climate change**

Across the world, few government policies are specifically dedicated to SHPs, although the Scandinavian countries and Germany have more clearly-defined policies than other countries (Henriksen et al., 2012). This poses a problem for the sustainability business because, without a clear policy, many developers and other stakeholders will refuse to commit, and it becomes difficult to develop an entire supply chains and closed loops if the industry is not sure what materials local planners will recommend. It is important to develop new policies that guide planning and provide consistency.

Another issue is that of assessing how to meet targets for sustainability, especially deciding whether it is better to support the market with policies for building new houses with CO_2 reduction in mind, or provide incentives for retrofitting older homes with sustainable technology (Banfill & Peacock, 2007). Many governments are promoting specific elements of sustainability, such as the recycling of grey water in countries such as Australia, USA, Japan, Jordan and Cyprus (Fountoulakis et al., 2016). Although welcome, this does not fully support sustainability in its entirety and may contribute to inconsistencies. New policies have to be enforced, so metrics for quantifying sustainability will help stakeholders ensure that systems will support the environmental, economic and social impacts of the development of SHPs (Marjaba & Chidiac, 2016). Of course, trying to develop policies is important, but the business of sustainability must also gain the support of politicians and encourage them to buy into the idea.

- **Inadequate government support**

In many countries, support for the development of SHPs is not consistent at both organisational and governmental levels, and governments may be more concerned with building in high volumes to ease social housing crises or ensuring that housing is safe. For example, in the UK, the British government realised that pressure exists in majority housing delivery and there is a need for a supportive policy that helps capitalise on the learning and practices of sustainable home builders (Seyfang, 2010). In the HCI now, the issue of government support requires political engagement and synergy at all levels as bridging these gaps is crucial.

Top down policies can provide consistency of approach and legal force to help businesses succeed, but policies may ignore the sensitivities of local communities. Ideally, policies should encourage local communities to participate in the development of sustainable neighbourhoods, usually with regulatory and financial support to help households and local businesses become active participants in sustainability (Garde, 2009). Affordability is a major barrier to many people otherwise interested in SHPs, and finance can be a powerful tool for removing obstacles and objections.

As an example, providing interest-free loans can help companies finance the development of sustainable neighbourhoods, especially where upfront costs are steep (Zhang, 2011). If participation is low, households and companies may become aggrieved if they feel that others residents are not reciprocating, especially where local governments fail to implement policies passed at governmental level (Shi, Yu, Zuo & Lai, 2017). Here, government agencies and NGOs can monitor the process and highlight potential problems before they occur.

In other words, sustainable business and housing policies must promote collaboration between stakeholders, supported by new authorities with the ability to make decisions that encourage participation. For any type of urban development, bringing together stakeholders and expertise to prioritise certain policy aspects allows cost-effective allocation of resources and promotion of benefits by encouraging private sector participation (Al Surf, 2013). The private sector is only one part of the process; the support of planners who can provide clear and consistent guidance is also necessary.

- **Low futuristic planning (Local government planning powers)**

Planning influences SHPs and businesses in several ways, because it affects the availability of land, dictates the permitted materials and technologies, and converts national policies into local contexts. The main challenge with planning is that it embraces the national and the local, and these do not always mesh seamlessly.

Planners balance issues such as drainage, flood protection, location, air quality and provision of services, because sustainability is a wider concept than energy efficiency, for example, which rarely encounters planning issues. Conversely, SHPs may support planning because some jurisdictions are more likely to permit buildings with smaller environmental footprints. Therefore, a wide-ranging planning policy could offset the restriction in supply caused by the additional costs of sustainability by easing planning restrictions and freeing up more land (Morgan et al., 2014). In other words, it is important to look at what planners want within the context of sustainability and to work with them to develop workable solutions. As an example, SHP planners should first consider the wider context before making small-scale plans. Small details can be taken into account, such as design orientation and land location, also taking into consideration the building envelope elements, such as shading for homes using passive solar energy, especially in higher latitudes with lower solar angles.

It is important to have a planning hierarchy and cooperation between departments for sustainable businesses to succeed. For example, in the UK, several governmental departments take responsibility for national planning, including the Department of Environment, Food and Rural Affairs (DEFRA), the Department of Communities and Local Government (DCLG), and the Department for Transport (DfT). These departments communicate with each other and, at the local level, local planners can insert policies into development applications to reflect local needs (Pickvance, 2009). Accordingly, businesses can adopt a similar hierarchy and engage with officials at all levels to ensure information flows up and down.

Overall, planning is the focal point of housing development and is the main driver for implementation of public policies. Planners must take multiple and often conflicting policies into account, such as building enough houses to satisfy local needs while preserving greenbelt land. Developers would much prefer consistent standards to replace the current patchwork of local planning regulations, because different systems create problems with procurement and economies of scale, hampering innovation. Another common complaint among developers is that many local policies have not kept pace with modern materials and techniques (Morgan et al., 2014). Sometimes, conflict between national and local planners extends to government departments, which often have their own priorities.

- **Legislative silos due to a lack of interconnection between government departments and private sector**

Often, a common approach and communication between different government departments is lacking so that, for example, policies to support SHPs conflict with health and safety legislation or contravene local planning laws (Pickvance, 2009). Individual government departments and ministers sometimes make decisions separately, creating policies for water, transport, waste, or energy, without considering the visions of other departments and the impact of such decisions on other infrastructures and developments.

Because changing a policy without considering new technologies and practices can create problems, broad solutions that cut across departments are essential. They can change the philosophies supporting housing development models and move planning, design, and wider understanding towards acceptance of the need for SHPs (Thorns, 2002). Cross-department cooperation and shared goals would produce legislation and guidance that support all three aspects of the sustainable business; namely, economics, environment and society. It would also help to streamline procurement by removing duplication and providing optimal solutions.

This is the antithesis of the business, which relies on creating value chains and closed-loops alongside building synergies between stakeholders. Accordingly, creating a business that merges environmentally-aware construction practices with design of new homes that contribute to social well-being should encourage policymaking that encompasses the needs of all departments. In other words, it should create a new and more coherent planning process that takes into account the needs of those who will live and work in the development.

- **Little consideration of SHPs when negotiating governmental procurement and contracts**

Procurement is a major foundation for the implementation of SHPs because it dictates access to resources and affects supply chains. Availability of resources is a key driver of cost, so policies to support procurement are essential. Procurement includes public procurement, making public land available for development, and developing planning policies to encourage sustainable procurement in the HCI.

However, at present, when developing protocols for government procurement and contracts in the public sector, little consideration is given to sustainability (Mokhlesian & Holmén, 2012; Sourani & Sohail, 2011). Value for the taxpayer, cost, and existing relationships with companies are emphasised at all levels of government, and governments often seek the highest price rather than the most sustainable usage when selling land (Morgan et al., 2014). This is understandable because they are subject to political accountability and pressure from voters to balance spending and taxation. Selling land for a high price can provide money to invest elsewhere.

The challenge lies in encouraging politicians to include sustainability within every stage of procurement, including social, economic, and environmental benefits alongside immediate value. Procurement should take into consideration the lifecycle of materials used; from design, materials, and manufacturing processes, to transportation and disposal. However, some countries have a less mature regulatory environment and need support in the form of shared expertise and incentives from buyers. Sustainable businesses in the HCI may require international regulations that allow governments to view public procurements as more than a simple business process with the aim of lowering costs. As an example, the UN’s

Sustainable Procurement framework brings together environmental, societal, cultural and financial benefits into a process that transcends national boundaries and improves the living environment and wellbeing of communities (Laryea, Agyepong, Leiringer & Hughes, 2012). Overcoming political challenges is a crucial part, but policies both influence and are influenced by economic factors.

2.4.3 Economic Challenges

Ultimately, developers need to make profit, and the ability of consumers to pay higher prices for sustainable accommodation is dictated by the economic conditions. The business model of sustainability in the HCI will have to overcome economic challenges by redefining the idea of value and showing that environment, society and local economies can benefit from sustainability. For example, while many developers are willing to overcome the technical challenges involved in sustainability, they believe that higher building standards raise costs significantly. Many studies suggest that the additional costs encourage developers to construct traditional housing (Poyton, 2003; WWF, 2002). In addition, the actual cost may vary from developer to developer due to different economies of scale and preferred construction techniques, making price predictions difficult.

The economic challenges cover any national and regional economic issues that can affect the application of SHPs over short, medium and long terms. It covers ideas such as high initial costs investment and up-front cost, affordability, lack of financial incentives and grants, limited demand risk of early adopters, long-term payback on investment, costs not reflecting savings, slow industry, cost-based industry, existing model used by the developers, high land cost and low availability, and low profits. Economic challenges can be predictable, such as government policy; or they can be unpredictable, such as the economic crash of 2008, so any model for implementation should be able to absorb such shocks. The main issues affecting SHPs include:

- **High upfront and initial costs**

Although SHPs, especially where prefabrication is used, can lower construction time, they have higher initial costs and cannot yet match the efficiency of well-developed supply chains used by traditional house building practices (Morgan et al., 2014). Developing wider and more efficient supply chains can be difficult and will involve manufacturers, vendors, contractors and subcontractors.

Complying with building codes that emphasise sustainability usually increases cost, adding over 25% to the cost of traditional house building (Morgan et al., 2014). Several models for reducing initial costs are available, but they must account for other building practices and regulations. For example, flat plate solar collectors are cheaper than the evacuated tube type, but are larger and heavier, thus making them impractical for some uses (Leckner & Zmeureanu, 2011). For some components, it is difficult to lower costs significantly. For example, one assumption for solar collectors is that their cost will decrease by only 1% per year after inflation, because the technology is mature and the cost of raw materials is likely to rise (Leckner & Zmeureanu, 2011). For Photovoltaic Systems (PVSs), another established technology, the only efficiencies are through reducing overall energy demand in a home so that a smaller system is needed. This is the type of joined-up design needed to maximise the efficiency of SHPs and lower initial investment costs (Leckner & Zmeureanu, 2011). Another way of offsetting high cost is by offering grants and incentives. One of the major economic challenges for any urban development, especially where house prices are high, is affordability.

- **Affordability**

In many cities, governments are trying to promote affordable housing to alleviate shortages, so cost is a major consideration for the sustainable business plan. Adding value at every stage of the process is important, alongside demonstrating to governments, developers and buyers' additional benefits for the environment, society and local economy. However, price will always be an issue in some areas and the business case for sustainability in the HCI must be able to produce affordable housing.

The growth of urban areas has seen demand outstrip supply across the world, making it more difficult for low- and even middle-income earners to afford housing in developing, as well as developed, countries. As an example, some studies estimate that over 800 million people live in substandard housing and shanties in the developing world, and this could rise to 1.4 billion by 2020. In some urban areas, including the US, Hong Kong, Australia and Ireland, only 63 housing markets out of 293 are affordable (Al-Saadi & Abdou, 2016; Desai, 2012; Gan et al., 2017). Not only does this have a direct effect on property prices, but it tends to raise the cost of living in urban areas.

With a rapidly growing global population, increasingly focussed in urban areas, much more housing is needed to cope with rising demand. Due to the increased strain on resources, SHP provides a solution for coping with urbanisation, but many families simply cannot afford even small increases in price. For example, one study suggested that suburban households spend 57% of income on housing and transport, while those in urban areas spent 45%. For both groups, affordability is a serious issue and no amount of social or environmental benefits can offset that (Chan & Adabre, 2019). Sustainability exists within the context of economic policy, and it should include social housing policies and other plans intended to make urban housing affordable.

- **Lack of financial incentives and grants**

Because SHPs can bring high upfront costs, investment and available cheap finance are crucial, and countries seeking to develop sustainable policies should stimulate investment with a combination of public and private finance. At present, it is difficult to obtain financing for SHPs, which restricts demand and compounds the high investment cost (Morgan et al., 2014). Consumers rarely prioritise sustainability, so policies such as reduced council tax or stamp duty for SHPs could incentivise the market (Morgan et al., 2014). Further, financial barriers are decelerating uptake, and any policies intended to increase affordability can have a significant impact.

Governments can offer financial incentives for projects that follow environmental standards, covering new businesses and existing companies, or guarantee private loans. Green financing can be a very powerful policy tool for stimulating sustainable tourism and supporting small businesses that might find additional costs prohibitive. However, most businesses often prefer the lower cost option, so incentives are important for promoting the benefits of sustainable practices. While financial investment can stimulate supply, demand is the other side of the equation, and governments and sustainable businesses need to address the risks for users.

- **Limited demand risk for early adopters**

In some cases the technology needed to implement sustainability in the HCI is presently expensive and early adopters will pay a higher price, restricting demand by creating risk (Nelson, 2016). This creates an issue, because the main way to lower costs is by expanding the market, but house builders and potential occupants are less likely to participate in sustainable business planning until costs decline.

In response, as more HCCs and developers implement sustainability and the technology matures, costs should come down as long as there are sufficient people willing to pay a premium while the technology matures (Cook, Bradshaw, Connelly & Baumann, 2005). Much of the argument for SHPs focusses on the economic impact, such as reduced utility bills. Considering the steep increases in energy bills and water/sewage costs over the past few years, a trend that looks set to continue, this should further increase demand for sustainability as long as the promised savings are realistic (Fountoulakis et al., 2016; Seyfang, 2010). Indeed, making unrealistic promises can have a detrimental effect, because unhappy buyers who feel that developers lied to them are not going to promote sustainability.

However, high utility costs could make buyers less able to afford the increased upfront costs of SHPs by restricting their ability to raise a deposit, an issue made more complicated by the reluctance of lenders to provide credit (Seyfang, 2010). This illustrates the importance of taking a holistic approach, because the financial investments for developers should also make SDs attractive to buyers by lowering prices. Another way to lower prices is to develop closed-loop production, which recaptures value at every stage of manufacture, installation and end-of-life.

- **Long-term payback on investment (not convincible)**

The premise behind SHPs is that reduced occupancy costs offset the high initial costs, but it is impossible to guarantee payback. In addition, the predictive practices and figures used may be inaccurate because they do not always take into account financial changes, such as increases in utility prices, inflation, interest rates, or cost of replacements (Leckner & Zmeureanu, 2011). In reality, any predictions are going to be difficult given the small sample size of the development. More sustainable houses and more data should help to refine the practices and improve predictions.

Payback can increase competitiveness for sustainability in the housing businesses, but most HCCs, with justification, believe that building SHP is more expensive than traditional one using tested techniques and supply chains. Part of this relates to the difficulty in estimating savings from less tangible benefits, such as environmental and social improvements (Choguill, 2008). Again, an increase in the number of SHPs and businesses in a range of environments, climates and community types should facilitate accurate estimation of the intangible benefits.

Several external factors affect payback, such as climate and geographical location. For example, PVSs are less efficient at higher latitudes, and payback is slower unless electricity prices are high. In Greece, a study by Fountoulakis, Markakis, Petousi & Manios (2016) showed that for a grey water system, the running costs meant that payback could be a reasonable 13 years with some model, but exceeded 70 years under other models. However, if costs for fresh water and sewage treatment continue to rise, this could make such models more attractive to buyers seeking financial reward rather than only addressing environmental concerns. Payback is compounded by the lack of a holistic business cases that incorporate intangible savings as part of cost/benefit analyses and, instead, focus purely on financial aspects.

- **The business model does not reflect savings**

At present, most housing development BMs do not take longer-term savings into account, because lack of customer interest means that developers tend to focus on the initial cost (Morgan et al., 2014). Savings are often described financially and do not cover cost to the environment, society and health. Developers and buyers would be more likely to include these costs in the payback equation if energy prices incorporated the real social and public health costs of producing energy, or if governments provided incentives for compliance (Leckner & Zmeureanu, 2011). Advertising and public education programs promoting the advantages of SHPs compared with traditional buildings will be important for promoting the business case.

Another problem is that business practices used to predict savings are not always accurate. For example, Banfill and Peacock (2007) point out that the model used to predict yield for wind turbines may be inaccurate because they use average wind speeds and do not always account for topography. Thus, the payback period may be longer than previously thought.

Accordingly, creating a BM for sustainability is not just about incorporating the benefits to society and the environment for cost projections within the industry. It will be important to look at the wider picture and encourage utilities, transport companies and suppliers to include these within their models, providing a true reflection of lifecycle cost compared with traditional building developments. Encouraging such changes can be difficult given the difficulties in persuading the industry to adopt new technologies.

- **Slow Industry**

SHPs require developers to adopt sustainability principles to streamline the system and maximise profitability and value at all levels (Larson, Teisberg & Johnson, 2000). However, the industry can be slow to adopt new technologies, sometimes because of natural conservatism, and sometimes because of an overall lack of support for innovation and adoption of new technologies.

The often-conservative HCI appears reluctant to embrace sustainability as part of its practices. There may be many reasons for this, including reluctance to broaden its knowledge because that requires significant investment in training for project managers and various other personnel (Larson et al., 2000). In addition, some countries do not have access to a reliable supply chain, and developing one is often out of their control and dependent on other stakeholders.

To compound the effect, there is currently low demand from customers for SHPs. This creates little market-driven pressure for innovation because investments in R&D or cost efficiencies may not be worthwhile at the moment. In addition, because of the small size of the markets, companies simply may not have the resources for developing and testing new materials and components (Morgan et al., 2014). Overall, while many businesses may want to adopt sustainability and become more environmentally aware, home construction is still a cost-based industry in which companies need to see continued profits and can be risk averse.

- **Cost-Based Industry**

At present, most elements of SHPs are cost based, where price reflects the cost of manufacture and distribution. Because there is low demand, market forces and supply/demand have little effect on prices. Moreover, the costs of materials, systems and labour can vary significantly over time. They can vary regionally or according to manufacturer, vendor or market conditions (Leckner & Zmeureanu, 2011). The business case for sustainability must incorporate ways to lower the cost of sustainability while showing that benefits, such as environmental, social and improvements to local economies, justify paying more.

HCCs may be reluctant to invest in new materials in case they perform poorly or require extensive and expensive training. New systems, if they fail within a few years, can cause reputational damage for companies and for sustainable industries in general. This creates a paradox, because developers want more real world data to show that materials work well, but it is hard for manufacturers to produce this data if developers prove reluctant to invest in their products.

One of the keys to changing this will be development of economies of scale and ensuring that materials are thoroughly tested, with meaningful data available to all. Across the industry, consistent standards and materials mean that supply chains and closed loops become viable, and financial incentives can lower perceived risk. The challenge lies in ensuring that the business addresses these issues and makes costs acceptable to industries, encouraging them to shift from their existing practices.

- **High land cost and low availability**

At present, one of the biggest restrictions on housing development in some areas is the high cost of land or localised pressure on resources. Over time, with sympathetic designs and a low environmental profile, SHPs could free up land restricted to other housing types (Morgan et al., 2014). However, this still acts as a barrier because HCCs operate within the context of demand and house prices, so increases in land purchase costs mean that they have to find savings in other areas.

Accordingly, the price and availability of suitable land influences SHPs, especially with planning regulations that make it difficult to free up more land suited for SHPs and communities. In addition, landowners and property markets expect a certain price for their properties and feel no compulsion to sell suitable land more cheaply.

Even with sympathetic policies and planning regulations, it is difficult to reduce land values, and developers must absorb the additional costs or pass them on to the final buyer. With few incentives for sustainability, implementing higher standards may decrease the supply of housing by raising prices. Developers wishing to build SHPs face intense competition from other land users, driving up the price and making SHPs financially unviable (Morgan et al., 2014). Accordingly, this is an area where working with planners to bring in regulations promoting sustainability will gradually level the playing field.

On the other side, low impact housing may persuade planners to free up land on which they would not otherwise permit development, and sustainable business models will eventually help to lower costs. However, until the business matures, and supply chains, technology and expertise become widely available, land restriction will still affect the financial viability of SDs. Ultimately, HCCs are businesses and often shy away from the low profitability of SD unless they have established a niche market.

- **Low Profits**

Ultimately, most of the economic factors explain the relatively low profitability of SHPs outcomes when compared with traditional practices. They create vicious cycles in which HCCs are reluctant to embrace new technologies because of the high expense and perceived low return. Because companies are reluctant to invest, there are few incentives for suppliers, product developers and architects to adopt sustainable businesses because they perceive that there is no market.

Accordingly, scarcity of demand and reduced pressure for innovation create no motivation for development of new technologies and processes that could increase profitability (Morgan et al., 2014). This lack of motivation is intensified by absence of competition within the supply chain, which would lower prices and introduce economies of scale. Price sensitivity and market forces are a problem in many areas because competition with cheaper, traditional houses, allied with high costs, can lead to lower than desirable selling prices and low profitability.

Offering incentives and promoting demand would alleviate this by allowing sustainable designs to compete with standard housing. Incentives and new standards across the industry would ensure that companies adopting new models were not disadvantaged and would give the practices time to develop and flourish. However, while this would address the economic factors for HCCs, social factors are important because a pool of buyers willing to spend money on SHPs and who understand the wider benefits of sustainability in the HCI would still be required.

2.4.4 Social Challenges

Because SHP covers more than just economics and finance, social challenges are crucial. Society influences the actions of politicians through the ballot box and shapes the philosophies of housing developers through market forces. In other words, sustainability must consider what people want and predict future trends. While environmental awareness and acceptance continue to grow, people still expect a house to be a comfortable and affordable home. A SBM in the HCI must consider the needs of society and show that local communities will benefit from SDs. Homebuyers and communities will be active participants in the process and shape how the business develops, making it crucial that their needs, which may vary according to local culture and norms, are taken into account.

The social challenges address socio-economic and cultural aspects, including lack of awareness, customer behaviours, difficulties in achieving the privacy concept, security issues, acceptance, interest, beliefs and, lastly, integration and communication with stakeholders. It covers the way consumer needs are shaped and how they affect SHPs by creating social pressures that shape legislation or make people more willing to invest in a particular technology. Other social factors influencing the uptake of SHPs include relationship to health, rising environmental awareness, education and labour costs. The main social issues affecting SHPs include:

- **Lack of awareness of sustainability (public, developer, government)**

Although SHPs have occupied a distinctive niche for decades, there is limited knowledge among the wider public, who may see it as elitist and expensive. The present market for sustainability relies on a core of committed environmentalists, and projects are limited in scale because few people combine the desire to help the environment with the financial ability to invest (Seyfang, 2010). Providing financial incentives will help but, looking at the other side of the equation, increasing environmental awareness could be equally important for sustainable business in the HCI.

Overcoming this requires an emphasis on the social benefits of SHPs rather than focussing on economic savings and technology. Only public pressure will force legislators to increase the availability and affordability of SHPs. One way to encourage this is to leverage increased awareness of environmentalism and public health, and to emphasise the need to improve overall living conditions (Marjaba & Chidiac, 2016; Seyfang, 2010). With growing environmental awareness among media and public, this could be a powerful agent for change.

All stakeholders should create arguments in favour of SHPs within the context of the positive effects on the environment and society, and promote awareness according to political beliefs, awareness of climate issues, culture, economics and geography. If consumers demand sustainable approaches, this will incentivise the private sector and encourage policies that move from economic growth to models that include environmental costs (Seyfang, 2010). In other words, the sustainable businesses that invest in raising public awareness now will reap future dividends.

To a certain extent, the sentiment among the public is slowly moving towards sustainable, zero-carbon housing practices, due to rising energy prices, increasing environmental awareness, certifications, and exemptions from stamp duty and other taxes (Osmani &

O'Reilly, 2009). However, especially in areas of high-cost housing, price is still a concern, and many still do not feel that the advantages outweigh the extra costs.

Low awareness of the advantages of SHPs is still a major barrier to increasing the demand for SHPs. Moving away from purely financial benefits and showing how a sustainable development can benefit a community, society and the local economy are bedrocks for encouraging the public to buy in to the idea. Importantly, education will also help people change their behaviour to reap the benefits of SHPs.

- **Customer behaviours**

There is sometimes an assumption that homebuyers simply walk into a sustainable building and immediately benefit from lower bills and a better quality of life. However, although contractors and designers state the potential savings of SHPs, this assumes that users are able to use the functions correctly (Banfill & Peacock, 2007; Seyfang, 2010). In other words, most practices only account for physical factors but, if the occupants cannot maximise the technology, payback times will increase. If people feel that they are not benefitting financially, then they are not going to promote the idea of sustainability or place pressure on politicians and industry to expand programs.

As an example, users tend to set thermostats higher than the optimal temperature, which reduces energy efficiency significantly (Banfill & Peacock, 2007). Home occupiers should be encouraged to understand technological advances, while builders also need to be aware of customer habits and understand how this will affect design (Morgan et al., 2014; Seyfang, 2010). One example is that the quantity and quality of grey water can depend upon the habits of residents, and this will affect performance (Fountoulakis et al., 2016). Once again, investing in information packs and awareness campaigns will ultimately reward all participants seeking a sustainable future.

Furthermore, in many cases, SHP policy is outlined as a policy on varying building methods instead of a policy on changing lifestyles when, in reality, the behaviour of the household is very effective when working to achieve more sustainable practices (Pickvance, 2009).

Changing consumer behaviour can also challenge the prevailing view that sustainability costs more.

- **Hard to achieve the privacy concept**

At the heart of SHPs and sustainable businesses is use of smart technology to promote energy efficiency and lower the lifecycle costs of housing. Smart technology also brings utilities into the business as part of creating value across a range of industry sectors. However, recent news items about hackers and data theft have created concern among the public that smart technology can leave their personal information at risk, which may make them reluctant to accept the technology.

Several technologies support SHPs, such as Ad-hoc Wireless Sensor Network (AWSN), direct radio communication, or less sophisticated Radio Frequency Identification (RFID) devices with an integrated circuit and antennae. For both the wireless and the wired parts, cybersecurity is crucial due to the risks of suspicious activity or terrorism. The Internet of Things (IoT) is another method, but this also needs improved reliability and cybersecurity (Stojkoska & Trivodaliev, 2017). Increased cybersecurity and protection of privacy are crucial, and will require cooperation between appliance manufacturers, utilities, developers and planners to create a unified approach.

Because many sustainable properties use smart networks for energy efficiency, these must be protected to safeguard the privacy of the occupiers. For example, if data is stored offsite, it can be vulnerable to hacking and theft of customer details. Various encryption and authentication techniques are available and should be factored into the design, with the support of utilities and telecommunication companies (Stojkoska & Trivodaliev, 2017). Of course, cybersecurity is not the only issue, and physical security is important for most homeowners, making it something that sustainable designers and developers should not forget. Other problems with changing customer perceptions include reassuring the public that privacy and security are guaranteed by SHPs.

- **Hard to ensure security**

For SHPs, physical and cybersecurity are crucial factors when developing sustainable communities. The first of these, related to the idea of privacy, is protection of data and smart networks from snoopers and hackers. The second is physical security and ensuring that occupants feel safe in their own homes, especially in areas with relatively high crime rates.

Smart technology is a core element of sustainability but is rarely discussed as part of sustainable design and policy making. As noted by Cozens (2007), too many sustainable building programs refer only to ecology and do not look at cybercrime and physical security in urban areas. These matter to occupants and, while embedding security measures will not contribute to the overall objectives of sustainability, it can create a more holistic plan by alleviating fears and overcoming objections from potential occupants (Cozens, 2007). Sustainable home developers should remember that occupiers still want many of the standard features of conventional homes.

Security and feeling safe are part of a wider factor; i.e., acceptance, which covers the fact that sustainable business models aimed at understanding the needs of occupants need to understand that people want to be comfortable, secure, and feel that a home reflects their personalities.

- **Acceptance, interest and belief in sustainability**

While cost and practicalities can influence demand, finance is not the only consideration when persuading homebuyers to embrace sustainability. As part of broadening the potential market, it is essential to show that homes are user-friendly and pleasant for users to live in. The implementation of SHPs should include ergonomics and aesthetics alongside costs, technology and legislation (Knudstrup et al., 2009). Naturally, cost saving is a concern during design, but identikit developments with ugly buildings will not attract buyers.

To promote acceptance of SHPs, developers may need to move away from the one-size-fits-all approach and consider the needs of the individual consumer for optimum temperature, daylight, ventilation and electrical appliances. If people are paying more for a home, they will expect an enhanced experience (Knudstrup et al., 2009). Moreover, it may be important to ensure that clients are willing to accept recycled materials and address any concerns about safety, toxicity, flammability and efficiency, especially if the price is higher than more commonly-used alternatives (Oyedele et al., 2014). The final occupants are very much part of the business and their input is as valuable as any other stakeholder's view.

As an example, one study suggests that HCCs lack confidence in many green technologies, with three-quarters believing that this is a major obstacle to uptake. Most concerns focus on predicted payback times and the durability and reliability of green products (Osmani & O'Reilly, 2009). There is a perception among the public, with some justification, that SHPs are much more expensive than traditional housing (Marjaba & Chidiac, 2016). Challenging this and showing consumers that sustainable business in the HCI can create financial, social and environmental benefits, is important. This culture also affects developers, because if they feel that price dissuades potential customers, they are less likely to accept the model. Of course, if legislation and planning standards start to promote sustainability, then the wider industry should participate in challenging this culture and promoting the intangible benefits of sustainability.

Developers need demand to create cost efficiencies, but demand will not increase until prices fall. Accordingly, developers must emphasise the cost savings over the lifecycle of the house and market the economic payback. However, this requires promotion of the other benefits of sustainable housing, ensuring that calculations are accurate with reliable metrics and realistic costs. In some cases, public perception of higher prices may be incorrect. For example, prefabrication is often seen as more expensive, even when this is arguable (Marjaba & Chidiac, 2016). If the SBMs are going to persuade customers of the benefits of sustainability, it needs developers to buy into the idea, so that they will promote sustainability. Encouraging designers, developers and occupants to work together is an example of creating integration between stakeholders for the sustainable business.

- **Integration with stakeholders**

One of the core tenets of sustainable business is promotion of links between the various interests and ensuring that all stakeholders work towards a common goal. Creating networks of shared interests is the optimal way of growing the industry and increasing demand. At present, there is a need for improved integration and communication between the various stakeholders in SHPs, due to the number of niche practices and the fragmented approach.

A more unified approach could produce synergies and help vendors and manufacturers provide a wider range of options and products using common standards and with better inter-compatibility. This should also include utilities, telecommunications, and local and national government to produce robust policies for integration of renewable energy sources and smart technology (Banfill & Peacock, 2007). Not only does this lower cost by preventing duplication of effort, but it also leads to common standards and compatibility between components.

Larger projects, such as sustainable community developments, involve many stakeholders, from local government down to residents, and other important stakeholders, including HCCs and residents in adjacent areas. All these groups will have different expectations and demands, and SBMs must balance these. As one example, an HCC must maximise profit, while local governance will try to balance the needs of the local economy, society and environment. Relationships between these stakeholders can be complex and sometimes antagonistic, although they can sometimes overlap. Accordingly, developing a community and neighbourhood requires compromise, which can be challenging because a group that feels left out will feel alienated and can become disruptive (Shi et al., 2017).

2.4.5 Technological/Technical Challenges

The SHP needs to rely on new technologies and innovation to create designs that are carbon-neutral and deliver the desired social, environmental and economic benefits. Sustainability is not just about the technology itself, but also the necessary supply chains and skills required for installation. Although new technologies can provide solutions, developers and planners may be reluctant to adopt them, especially if untested in real world conditions.

Design and technical shortcomings, at present, are a challenge to building sustainable homes, especially for small developments. As an example, renewable energy is prominent in most sustainable designs, but can be unreliable and take up outdoor living space, which can be scarce in urban areas. In addition, developers might not be able to recover the cost.

Another technical barrier is the fact that most developers use standard products and designs to reduce costs and ensure that materials are tested and easy to replace. Accordingly, for large developments, HCCs can be unwilling to embrace new standards that require design changes. This creates the impression of conservatism and cultural inertia among builders. To a certain extent, builders prove naturally unwilling to adopt innovations and non-traditional techniques, but some of this risk aversion is understandable considering the potential damage to profits and reputation if materials and components do not perform.

The technological challenges include the influence of technology and can include the latest technological advances and barriers, alongside R&D investments by government and large organisations, IT advances, automation, new materials, and ability to invest in technology. This also includes technical issues – such as shortages in skills availability, training programs for new technologies, and a lack of partnerships across the business environment network – and considers issues relating to the pace of innovation, the need for flexible designs, data processing and materials innovation. Because technological challenges are a major concern for sustainable businesses in the HCI, this factor is broad, also covering shortage of design expertise, battery limitations, underdeveloped supply chains, and a lack of information, low cost technologies, and local materials. Some of the main issues within this factor are discussed below.

- **Shortage in sustainable practices**

Shortage of expertise is a major issue for SHPs because developing technologies that can provide real solutions requires expertise at every stage of the development. This includes developers, manufacturers, contractors and, importantly, planners who need expertise to understand the benefits of new technologies. One problem is that if companies do not know which technologies are likely to become prevalent, they will not spend money on training. In this respect, the business case for sustainability should specify the optimal technologies, support their continued use, and ensure that they become standards.

At present, there are few designers and contractors with expertise in building sustainable buildings, and this could affect the cost (Morgan et al., 2014; Stojkoska & Trivodaliev, 2017). Through simple labour economics, if individuals or companies have specialist skills that are in great demand, they will tend to charge more money. Likewise, if companies want to train their own staff, this takes time and money that they will add to the cost of the building. However, wider training programmes across the industry would eventually offset these costs and reduce prices (Morgan et al., 2014). For example, in many industries, product vendors run training courses to ensure that end-users understand installation techniques.

One way to encourage such industry-wide initiatives is by creating example sustainable neighbourhoods and communities to provide a reference point and provide a pool of knowledge by developing the necessary expertise. An example will show stakeholders what is needed to develop such communities and their role in the process (Shi et al., 2017). Expertise in a particular technology is essential, but skills have to filter throughout the workforce, or it can lead to similar problems.

- **Skills shortage**

At present, for many technologies, there is a lack of relevant skills within the industry at all stages, including planning, design and construction (De Feraudy, 2014; Fountoulakis et al., 2016; Hager et al., 2016; Leckner & Zmeureanu, 2011; Marjaba & Chidiac, 2016; Morgan et al., 2014; Seyfang, 2010; Stojkoska & Trivodaliev, 2017). For example, most contractors have little expertise in installing and orientating solar PVSs for optimal efficiency (Duce et al., 2018). Carpenters need to have an understanding of the supply chain with respect to sustainable forestry, while Heating Ventilation, and Air Condition (HVAC) contractors, due to the critical nature of ventilation within sustainable housing, have to balance skills, such as ability to measure air quality, energy consumption and heat recovery (McGraw-Hill, 2012; Morgan et al., 2014). For a functional BM, workers can no longer operate solely in their own field and should understand other parts of the chain. They will need to be familiar with the way they work, and where they fit into the idea of sustainability.

Even if HCCs learn the relevant skills, SHPs also report shortages in management skills, such as project management and the communications needed to ensure that stakeholders work to a common goal. Unlike traditional practices, HCCs now have to liaise with other trades to fulfil design requirements and maximise efficiency (Bevan, 2016). In other words, architectural expertise and established project management processes will prove invaluable.

At present, approaches within the construction industry are fragmented and there is a shortage of relevant skills. There is also a tendency to exclude suppliers and subcontractors from collaborating on skills training and apprenticeships, so sustainability has to be promoted and accepted at all levels (Morgan et al., 2014). However, most sectors of the industry lack training programs to overcome these issues.

- **Shortage in Training**

As discussed in the previous section, training is the key to success for the implementation of sustainability principles in the HCI, because experts and workers need training in new technologies and techniques, but also in the ways other areas of the industry work. In other words, rather than learning skills in a linear fashion, training becomes more about developing interlinked networks of skills. While this is desirable, setting up such training programs will be a challenge, especially when it requires investment.

HCCs can be conservative, and lack of institutionalised learning means that they cannot always cope with financial and political shocks, leaving them unable to adapt to new opportunities (Seyfang, 2010). Sustainable businesses need new approaches to construction and training, but the 2008 financial crisis saw construction companies cut costs, and the number of apprentices fell (Morgan et al., 2014). Clearly, setting up training schemes requires support from the private and public sectors to increase the supply of skilled apprentices.

Developing training programmes requires partnerships and cooperation between stakeholders, because developers, designers, suppliers, contractors and subcontractors need constant training in new technologies (Morgan et al., 2014). Finally, it is beneficial to scale up the lessons learned at grassroots level and replicate these across larger companies (Seyfang, 2010). Training requires experts but developing these within the SBM is not a simple process. It is important to promote the benefits of training, but equally important to ensure that these are supported by innovation.

- **Innovation is slowly developed**

Because SHPs are a relatively new industry, especially for larger developments, innovation is essential for ensuring that SHPs can access mature and proven technologies. Currently, innovation within the industry is poorly developed, partly due to a lack of regulatory pressure, and partly because there is lower demand from customers for SHPs (Knudstrup et al., 2009; Morgan et al., 2014; Oyedele et al., 2014). Absence of a large market decreases the impetus for innovation and change, because investments in R&D or cost efficiencies may not be worthwhile (Morgan et al., 2014). At some point, the business will have to inject capital into the process to break this cycle and encourage innovation.

At present, SHPs tend to exist in niches that can be localised according to geography, culture, economics and politics. To promote innovation, these niches need to integrate with the mainstream and meet similar standards. This may help them become more compliant with regulators and planners, although it may push innovation towards fulfilling technical requirements while neglecting affordability and social benefits (Seyfang, 2010). Other stakeholders with knowledge of social issues and the importance of social housing will need to guide the process.

As an example, China faces barriers to adoption of a holistic sustainable development process. Shortage of technological innovation, in particular, within the country, forces China to import technical expertise. Over 90 per cent of solar cells manufactured within China use technologies developed in other countries, incurring license fees that add to the cost of manufacturing and installing photovoltaic arrays. To compound this problem, scarcity of managers with technological experience means that companies are unwilling to take risks due to the potential for financial loss, especially for technologies new to the country. Accordingly, many Chinese companies are unwilling to take risks and develop new sustainable technologies that could incur significant expense for very little return (Shi et al., 2017). It is important to combine the various localised niches in a mainstream model, but the SBM should not adopt a one-size-fits-all approach and lose the ability to create flexible designs.

- **Adaptability and flexible design**

SHP is a home, and it should allow some flexibility of design to suit the needs of the occupier alongside incorporating sustainability, cost, and ease of construction (Knudstrup et al., 2009). However, it is important to note that SHP incurs additional design costs for choosing materials and assessing their impact (Morgan et al., 2014). Different areas have different requirements, such as climate control, so solutions for humid regions will differ from those of drier areas (Knudstrup et al., 2009). In much of the world, wastewater recycling is becoming more common due to increasing water shortages brought about by climatic changes and population density (Fountoulakis et al., 2016). Like conventional housing, SDs will have a local flavour in terms of usage, aesthetics and available materials.

Luther (2009) notes that there is still a stigma attached to prefabrication, due to the perceived design inflexibility, lack of choice of materials and finishes, and resulting lack of diversity if scaled up for larger developments. However, it is fair to note that most new build housing developments see some standardisation of design. In addition, Computer-Aided Design (CAD) and other techniques now allow a higher degree of design diversity and customisation, which can be realised by providing a list of standardised parts supporting a 'mix and match' approach. Another potential advantage is that, even for completely bespoke designs, CAD technology will allow prototyping and more efficient manufacture (Luther, 2009). However, CAD and increasing the number of designs increases complexity and requires greater computing power.

- **Lack of closed-loop production**

Closed-loop production describes the process of improving sustainability by achieving simultaneous economic and ecological goals. While the business of sustainability will use fewer resources, it will also ensure that waste and materials are recycled at the end of their life to lower the environmental footprint and recapture costs in the business cycle.

Such production builds better links between companies in the supply chain to cut waste, transportation and energy consumption, while promoting recycling. At present, due to the fragmented nature of the SHP supply chain, this is not apparent (Glukhova, Erimasita & Glukhova, 2015). Sustainable Supply Chain Networks (SSCNs) are one proposed method for creating closed loops and circular economies that will promote sustainability and improve the overall economic and environmental benefits.

- **Data processing and memory**

For prefabricated buildings, new database technologies and building information modelling (BIM) will support templates, and the systems will support bespoke design, prototyping and testing to allow individualisation of design (Luther, 2009). In addition, handling data produced by a smart home requires high processing power and data storage capacity, which requires 'big data' solutions. This requires expensive data storage solutions off site, complex data management programs, and produces potential problems with cybersecurity and customer privacy (Stojkoska & Trivodaliev, 2016). Developing plans that can keep up with the latest technologies and changing threats will require liaison with IT companies, telecommunications and consultants.

- **Materials innovation**

The resources available for innovation and the development of new materials required by SHPs are limited (Hager et al., 2016; Oyedele et al., 2014; Seyfang, 2010). One possible way to overcome this is with 3D printing technology for production of filaments used in insulation products or for strengthening materials (Hager et al., 2016). These technologies are presently under development and could speed up production, reduce wastage and minimise pollution, but Three Dimension (3D) printing still has many limitations. Although the technology could produce cost savings and reduce the occupational health risks of working with fibres and powders, it could lead to a loss of jobs for many workers in the construction industry (Hager et al., 2016). However, automation and new techniques threaten jobs across many industries, requiring governmental policies and reshaping of the labour market that extends beyond SHPs.

Although some manufacturers and vendors are using recycled materials for their products, this is not yet widespread, partly because SHPs are a small market with little scope for innovation (Seyfang, 2010). Many advances in reuse of materials occur when a product becomes a cost-effective alternative in traditional building. Many products are made from recyclable materials, but there is no guarantee that there will be a sufficient supply or production capacity for larger projects (Hager et al., 2016). Many manufacturers must be sure that there will be enough market growth to justify investments in expansion and new equipment.

- **Lack of experts**

Because SHP is still a niche market, designers and architects skilled in developing sustainable projects are relatively rare (Knudstrup et al., 2009; Leckner & Zmeureanu, 2011; Luther, 2009; Seyfang, 2010). In addition, there is a lack of expertise among other stakeholders, including planners, utilities, and material producers (Morgan et al., 2014). However, education and training programs are now more aware of environmental issues and sustainability, but there is still a shortage of architects with knowledge of many aspects of design, especially with respect to localised conditions and climates (Knudstrup et al., 2009; Union, 2011). Due to the long lead-time in training architects, it is something that should be happening now, but this is difficult when technologies are still developing.

- **Limitation of mature green/sustainable and effective supply chain**

One of the main attractions of SHPs is the reduced environmental footprint, and use of local materials with minimal energy output during transportation lies at the heart of developing 'Low Impact' housing (Morel, Mesbah, Oggero & Walker, 2001). Many localised initiatives use local materials, such as earth, timber and straw bales, but these are for limited developments or single homes. For larger developments, these materials would prove too labour intensive and require highly specialist skills, making them impractical (Luther, 2009). Materials aligned with more common building techniques would need to be brought from further afield, which raises the issue of carbon dioxide emissions during transportation (Seyfang, 2010). Development of supply chains will require political support and liaison with all stakeholders, but this process is hindered by shortage of information.

- **Lack of information**

A study investigating the challenges of SHPs delivering zero carbon homes from a feasibility perspective suggests that approximately three quarters of respondents felt that the lack of reliable information and lack of financial incentives are major barriers for SHPs (Osmani &

O'Reilly, 2009). With few studies suggesting a net cost and overall profitability of zero carbon homes, developers working to thin profit margins have no idea of the costs of fulfilling standards and are reluctant to take risks.

One reason for this is the infrequent use of metrics due to inaccuracy or over-complication, indicating the importance of developing usable metrics to quantify sustainability at all stages of the process. The common and comprehensive Life Cycle Assessment (LCA) metric can capture many aspects of sustainability and is compatible with standards (Leckner & Zmeureanu, 2011). However, LCA requires a lot of data, some of which may not be available, and can be difficult to apply to complicated systems, such as buildings and associated infrastructures (Marjaba & Chidiac, 2016). Another potential issue is that LCAs measure the environmental impacts, but do they capture the social dimension?

Other metrics, including LEED, BREEAM (Building Research Establishment Assessment Method), CASBEE (Comprehensive Assessment System for Building Environmental Efficiency), Green Star, and others, are used less often in academic studies to measure sustainability. These metrics are not always repeatable and do not always give an idea of performance (Marjaba & Chidiac, 2016). Other metrics, such as National Energy Codes, are useful but only address a single element of sustainability. The other problem concerns the lack of information in regulations and guidelines, and the limited repository of knowledge covering sustainable building, which is natural for a relatively new concept.

The business of sustainability will need to operate as a network of shared interests moving towards common goals, which requires sharing of information so that planners and developers are aware of the risks and the costs involved. Information helps policymakers understand the needs of customers, and customers can access information about payback time or understand what they need to do to maximise the benefits of their home. However, the lack of information on the effectiveness of SHP affects policy decisions and makes it more difficult to attract customers interested in cost savings.

- **Difficult to exchange knowledge and cooperate with traditional practitioners**

The challenge for individual builders is that they may not have access to the specialised skills and resources that larger companies can provide, and this will restrict grassroots initiatives (Seyfang, 2010). Smaller builders and companies may lack the resources needed for developing new technologies. Conversely, it is difficult to take knowledge gained by small-scale builders and replicate it on a larger scale, and their ideology for building could clash with economic considerations of larger companies (Seyfang, 2010). To remedy this, there should be a two-way exchange of information and practices between niche builders and large contractors; the experiences of individual clients could be useful for any BM. Examples of practices that can be transferred from the niche to the mainstream are thermal mass for internal temperature, south-facing aspects and rainwater collection (Seyfang, 2010). Sustainable businesses could also promote knowledge sharing among designers, developers, product manufacturers and builders to build a pool of data and best practices.

At present, architects, smaller constructors and individual homebuilders use many of the technologies for the application of SHPs. However, large-scale builders have not always adopted lessons learned by small-scale builders. Accordingly, the new case should be a highly scalable model that encourages cooperation at all levels, with small- and large-scale developers creating partnerships rather than working alone – or even acting as competitors in a small niche market. The problem of scale regarding information sharing is sometimes apparent with technology, which can be difficult to develop for both small and large developers.

- **Lack of low cost/scalable technology**

At present, there is a lack of low cost technology that can scale up to suit developments and benefit from economies of scale, because SHPs are largely niche-driven (Hager et al., 2016; Luther, 2009). It is important for manufacturers to know that there is going to be a market for their product before they invest significant resources in expansion of production capability (Hager et al., 2016). One area of potential growth and lower cost is prefabrication, with buildings assembled off-site and constructed quickly. Luther (2009) notes that fabrication can reduce waste during production, making it easier to incorporate renewable systems and optimise performance by reducing construction errors. Within the controlled manufacturing processes of a mass-production environment, this allows for enhanced quality control and efficiencies of scale.

Luther (2009) notes that a prefabricated building can be erected quickly, with a significant reduction in weight and a resulting 70% reduction in the foundation needed, bringing environmental benefits and cost savings through mass production. However, a change in government regulations could render an entire production line obsolete and require retooling and retraining.

3D-printing technology could create filaments, such as insulation, and would allow scalability while reducing the need for material storage and transport requirements, lowering financial environmental costs. The technology could lower energy demands, reduce the amount of raw materials needed and create less waste (Hager et al., 2016). However, long-term studies would be necessary to assess the suitability and durability of materials.

One of the strengths of developing a wider BM, rather than focussing on the construction aspects of SHPs, is that it can include developments of all sizes, each working towards common goals. The problem with prefabrication and many sustainable technologies is that there are often few local suppliers and an overall lack of alternatives that can promote competition, lower prices and increase innovation.

- **Lack of local materials and single supplier for materials**

Lack of local materials makes SHPs more susceptible to tariffs and currency fluctuations (Hager et al., 2016; Pickvance, 2009). It also means that a project will incur environmental costs for the transportation of materials. For example, many prefabricators are based in Scandinavia and Germany, so builders have to import unwieldy products to the UK (Hulme, 2009). Apart from the costs in terms of carbon dioxide emissions, transportation affects the affordability of the final building.

It is suggested that absence of a well-developed supply chain for SHPs is a disincentive for construction of prefabricated buildings in particular (Marjaba & Chidiac, 2016). Accordingly, networks connecting manufacturers and vendors should be encouraged because a defined supply network and stable supply will incentivise return on capital and provide cost savings through economies of scale (Banfill & Peacock, 2007). However, the limitations of the supply chain make it difficult to change, and government policies, such as taking the cost of CO_2 into account to incentivise change, may be required (Morgan et al., 2014). As illustrated above in relation to transportation and environmental impacts, the technological factor merges with environmental factors in many areas.

Although the SHPs acknowledges that some materials may require transportation over large distances, and incorporates this into the carbon footprint, local suppliers and materials could help reduce the environmental impact while supporting the local economy and communities. However, it is difficult to create a network of local suppliers if there is no market or support from building regulations and specifications.

2.4.6 Environmental Challenges

Although SHP promotes intangible benefits, such as improving society and contributing to thriving local economies, it is important to remember that protecting the environment has always been the major driver. SHPs have emerged from the desire to reduce the environmental footprint of dwellings and developments with the use of new technologies and new materials. The sustainable business does not want to lose the focus on the environment, and merely wants to add additional benefits, such as improving neighbourhoods and bringing sociological benefits to local communities. In some ways, environmental factors are the easiest challenges to overcome due to the amount of information available. Conversely, governments often focus on global environmental issues and fail to address local environmental concerns (Pickvance, 2009). In the same way, it is important to work with planners at all levels to address global and localised environmental concerns. As an example, buyers will not purchase a home on the promise of carbon neutrality if it is located near an industrial plant spewing pollution.

While it is easy to assume that reduced impact SHP automatically preserves the environment, the reality is more complex. SHPs affect the environment in many ways and on many scales, such as producing $CO2$ on a global scale, or increasing local flood risks. These multi-scale impacts and the local nature of many environmental issues mean that measures intended to remedy environmental degradation tackle only some of the impacts (Pickvance, 2009) For example, deteriorating environments pose a particular problem for sustainable neighbourhoods in urban areas because they can affect the health of communities. SHPs exist within a particular context, and depleted resources, such as water availability or lack of access to reliable energy, have a negative impact. The local environment can only cope with a limited population density before it undergoes damage and resource depletion. In other words, for a SHP, the environment must cope with any additional demands and provide the basic resources necessary for wellbeing. However, they can help communities cope with deteriorating environments by using resources more wisely (Shi et al., 2017). Of course, in building public support for change, this also requires community education to show people how and why this is important.

The environmental factor includes ecological and environmental aspects, such as climate change, lack of local resources, pollution, land location and production of waste, all of which may have a significant effect on sustainable housing design, and high waste industry. Furthermore, growing awareness of the potential impact of climate change is affecting current practices by creating new markets and diminishing or destroying existing ones. The main environmental issues affecting SHPs include:

- **Climate change**

Various governments have taken actions to address climate change, mainly by reducing fossil fuel use through alternative energy sources (Knudstrup et al., 2009). Few have looked at how SHPs could reduce CO_2 emissions during construction and occupancy (Riley & Cotgrave, 2013). Under the Obama administration, for example, grants promoted a rapid expansion in the renewable power economy, and similar support for SHPs could provide similar impetus. Conversely, politicians focussing on climate change and extreme weather may emphasise CO_2 emissions and fail to support the other advantages of SHPs (Karvonen, 2016). As with many environmental factors, because the environment is newsworthy and can attract voters, policymakers often emphasise these benefits, seeing them as easy gains.

At present, few governments have embraced SHP to meet emission reduction targets, which means it often remains a niche market. Overcoming this challenge and encouraging governments to view business practices for sustainability to tackle climate change is important to the evolution of the plan. The environment poses other problems because weather conditions can shape the type of SHP needed.

It is difficult to use completely standard designs and approaches for SHPs due to seasonal variations; different climates requiring different solutions (Knudstrup et al., 2009; Morgan et al., 2014). A development in an area with cold winters and hot summers would need different approaches to climate control, building aspect and external materials compared with that required for a mild, wet climate. Seasonality can also affect the use of renewable energy sources due to variations in wind power and frequency, and the solar angle at different times of year. Accordingly, seasonal variations should form part of the initial design process (Knudstrup et al., 2009). Because many renewable energy types now have mature markets, there should be a wealth of data on seasonal fluctuations to support this.

- **Lack of renewable sources of energy and water**

Some locations may be unable to benefit from renewable energy due to lack of sunlight or wind (Banfill & Peacock, 2007b). In addition, using renewable installations to offset carbon emissions must consider technical issues when connecting the supply to the wider grid. To protect infrastructure, personnel and public, utilities need expensive inverters, software and hardware to support automation in the distribution system. Without this, there is a limit to the amount of distributed generation that can be installed on a circuit or system (Banfill & Peacock, 2007). Most power grids are ageing and may not be able to fulfil future demand, especially if use of electric vehicles increases (Stojkoska & Trivodaliev, 2017). Overall, sustainable developers should work closely with energy suppliers to maximise design efficiency.

Renewable energy is an important component of many SHPs and a relatively well-supported way to reduce the carbon footprint of homes. Accordingly, it forms an integral part of fulfilling corporate environmental goals. However, the efficiency of renewable sources of energy can vary, so plans must be flexible enough to cope with sporadic generation. Access to water is a similar issue because it is not possible for every sustainable development to use grey water recycling or similar water-saving measures.

- **Hard to insure prevention from pollution**

Traditional models generate waste and pollution, and just over half of all the wood consumed on the planet and 40% of the energy is used for building construction (Akadiri et al., 2012). A third of all buildings expose occupants to poor quality air, often laden with mould spores or chemicals, while one third of landfill solid waste originates from construction. However, most environmental damage occurs over the lifecycle of a building due to the occupants. Sustainable design can reduce the impact during construction but also during occupation and demolition (Marjaba & Chidiac, 2016). Again, this stresses the importance of the new models to look at products and housing across the entire lifecycle, from manufacture to recycling.

Off-Site Construction (OSC) may bring positive benefits by lowering the amount of pollution, such as reducing waste to less than 5%, and it is much easier to separate materials for recycling (Luther, 2009; Marjaba & Chidiac, 2016). Reduction in transport and energy consumption is an additional benefit alongside the normal benefits of a sustainable home, such as enhanced thermal characteristics and reduced labour/production time.

While carbon dioxide emissions tend to become the main selling point of SHPs, pollution prevention is equally important. For the sustainable business, this will reduce the amount of waste entering the environment during construction and occupation and prevent pollutants from harming occupants or their surrounding community. Because pollution does not always gather the same headlines as climate change, it can be more difficult to persuade politicians and public of its importance.

- **Land Location**

Land location and use can create other conflicts where urbanisation is particularly rapid (Chan & Adabre, 2019). For example, in China, urbanisation saw the creation of very unsustainable areas where cost was the main concern. These areas are often polluted by industry and are resource depleted, so the cost of reusing these brown sites and creating sustainable neighbourhoods is high (Shi et al., 2017). In addition, it seems logical that developers may shy away from such sites because they fear litigation if occupants face future health problems.

Land location is important for SHP development because the location is subjected to environmental conditions, including the amount of wind and sunlight for operating renewable sources. SHPs should be permitted where environmental concerns forbid traditional construction (Knudstrup et al., 2009; Morgan et al., 2014; Seyfang, 2010). One case study developer considered that no suburban new build could be sustainable because of its location relative to sustainable transport, and promoted compact inner-city development, while registered social landlords championed rural exception sites in villages (Morgan et al., 2014). The final environmental factor in this analysis is use of the sustainable business view to reduce waste, a major problem for the construction industry.

- **High Waste Industry**

The environmental impact of constructing, maintaining and living in housing is difficult to measure because it includes many factors. Therefore, it is difficult to assess concepts such as the success of SHPs (Chan & Adabre, 2019). All housing consumes energy and environmental resources, and there is little information about what factors contribute to critical success studies. This makes assessing the relative success and the level of sustainability in a project difficult, especially across the whole lifecycle of developments.

Most assessments consider the materials used and how they contribute to environmental preservation because this is a relatively easy metric to measure. With such a difference in the purchase and rental prices of sustainable housing when compared with affordable housing developments, better models are essential for providing a picture of the relative costs over time (Chan & Adabre, 2019). As with many of the metrics used for SHPs, a larger pool of data is needed to help perform accurate calculations.

Although SHPs aim to produce less waste than traditional techniques, wastage is still a concern for any business (Marjaba & Chidiac, 2016). Developing a new sustainable business requires the use of eco-friendly, renewable resources where possible, but also closed-loop production with recycling and reuse of materials. Apart from an ecological function, this can create value, but it takes time and cooperation between stakeholders to create and refine these processes. In considering solutions to these issues, Hager (2016) suggests a training and refinement of installation techniques and design, use of CAD to inform product procurement without over-ordering, and use of prefabrication and new technologies, such as 3D printing, to reduce waste.

2.4.7 Legal Challenges

For the SHPs to succeed, legislation is an essential part of the overall framework. It can create a level playing field by ensuring that some businesses, following early adoption, do not suffer financially, and that standards force companies to innovate. Although many jurisdictions have voluntary codes, these are rarely successful because developers following these principles usually incur higher costs, creating a competitive disadvantage. Enshrining SHPs in legislation would ensure that all follow the principles.

HCCs will gain experience in building techniques, design, and procurement as they seek to fulfil the new legislation as cost effectively as possible. Well-designed legislation for SHPs and certifications for energy performance, such as Energy Performance Certificates, can reduce carbon emissions while lowering costs and create optimal conditions for sustainable development (Adeyeye, Osmani & Brown, 2007). In other words, policies are sometimes ineffective, but specific legislation can have a positive effect on building construction.

The idea of a level playing field based on minimum standards is important to the business, because it encourages cooperation between stakeholders as they look for ways to fulfil them. At present, most building regulations in countries such as the UK focus on structural strength and the safety of occupants. In 2002, the UK also introduced regulations strengthening the requirements for insulation, thermal bridging and energy efficient lighting. Requirements for energy efficient boilers followed and, in 2006, the EC introduced a method for assessing CO2 emissions and mandated a 20% improvement in the conservation of fuel for new buildings and improvements in ventilation. Over the years, the level of sustainability embedded in building regulations has increased and is now a driver of change. Of course, whether regulations are effective or enforced is still open to question (Pickvance, 2009). Many countries have problems with bribery and other types of corruption in the construction industry.

Legal factors include absence of mandatory targets in response to climate change, weak regulations and standards, and absence of a national sustainability rating system. These factors affect the implementation of SHPs, its costs, and demand for its products. Legal issues affecting SHPs are discussed below:

- **Response to Climate Change is not Mandatory**

Climate change also creates a paradox because rising global temperatures increase demand for energy. Climate change may influence temperatures even more over the next decades, potentially increasing the need for energy-hungry climate control, which will include air conditioning and heating (Barker, Ekins, Johnstone and Titheridge, 2016). Buildings will have to cope with higher summer temperatures and more extreme winter conditions. Because of climate change and the evolving legislation, building technologies must evolve as part of CO_2 emission reduction strategies (Seyfang, 2010). Even if stakeholders accept the need, laying out exactly how to achieve it is an important consideration.

However, there are no mandatory targets for reduction in the industry, with most targets focussed on renewable energy and energy efficiency. While some building standards cover this, there is little wider legislation governing products from manufacture to installation or focussing on the construction process rather than the building lifecycle.

To a certain extent, government intervention and target legislation drive legislation from the top, and climate change is a large part of this. Mandatory climate change legislation to support the SHP as it creates a level playing field is a major factor. At present, while governments are increasingly adopting emissions targets, these are broad and do not define exactly how they can be achieved, or they rely upon voluntary codes (Pickvance, 2009). The absence of definitive regulations results in a lack of direction for sustainable business, making it difficult to bring about change.

- **Weak or definitive regulations**

In some countries, such as China, few regulations cover use of environmental resources. For sustainability to be successful, national governments must introduce robust and enforceable national and local environmental regulations. Any such sustainable development requires resource investment from the public and private spheres, but environmental policies can prolong development times and thus affect the payback period, creating a disincentive for developers. Any additional delays to completion of a development can affect profits (Shi et al., 2017). Regulation and planning should create an efficient and transparent process for seeking approval. Improving sustainability in building developments requires effective environmental policies and shrewd use of natural resources, but this needs regulatory support. To compound the issues relating to inadequate regulations, lack of standards also provides an obstacle to implementation of SBMs.

- **Inadequate national sustainability rating system**

At present, few sustainability rating systems cover SHPs, and those that do exist tend to have a narrow focus, such as stipulations for energy efficiency or zero carbon design. Another problem is that standards are rarely universal and do not always translate across international boundaries. Some developers import standards, such as LEED, but these can be geographically specific and do not suit every region (Shi et al., 2017). Internationally recognised standards, like the ISO process, may be the way forward to promote consistency of approach.

Morgan et al. (2014) estimate that a zero energy building will cost 2.5%-12.9% more, and argues that energy efficient building should conform to a single standard within the building regulations for zero carbon housing. Another area where standards are a problem is smart home solutions due to the cost of integrating devices. Standards should apply to all stakeholders, including designers, telecommunications and electric utilities (Stojkoska & Trivodaliev, 2017). Most industries have standards, but are these always compatible with sustainability?

Creating standards requires metrics that can define needs, what is feasible, and whether standards are working. In this respect, metrics used include BREEAM in the UK, DGNB in Germany, and LEED in the USA. Although focussed on environmental impacts, they can measure building sustainability, but they may emphasise environmental concerns above economic and social benefits (Marjaba & Chidiac, 2016). It is useful to assess and quantify the sustainability performance of components, but some measures for prefabricated products are only testable when the building is complete and cannot be changed, although the findings could shape future projects (Marjaba & Chidiac, 2016). This means that the resulting standards for performance should be ‘as built’ standards to shape regulations and encourage compliance (Morgan et al., 2014). Once again, creating a body of accessible and accurate data should become a major goal for the SBM to help create informed policies and approaches.

Standards for SHPs provide guidance for governance and industry stakeholders as well as helping potential occupants evaluate sustainability. Without a set of standards, as seen in China, developers and planners lack guidance and this can create a fragmented approach. Standards can tie the SBMs together and encourage stakeholders to work towards a common goal, ensuring that developers, architects and materials manufacturers develop solutions for compliance.

2.4.8 Discussion of International SHPs Challenges

Implementation of SHPs is facing many major challenges. These major challenges require economic and technological growth to be present for the society to allow effective application. Discussion on the major challenges face the implantation shoes that the chief barriers are by order economic, technological, social, political, environmental and legal. Importantly, rather than trying to overcome these challenges individually, there is a need for an entire SBMs framework that work as a holistic approach to encourages all stakeholders to develop common solutions. The framework will move the SHPs process from a niche-driven endeavour to a multifaceted business approach that uses policies, regulations and standards to shift thinking from purely environmental to social and economic.

Some of the main issues include a lack of definition and awareness of what sustainability entails, making it difficult to develop final goals, policies and integration between shareholders. Another barrier is lack of market maturity and the resulting high upfront costs, limited demand, land shortages, limitation of mature sustainable and effective supply chains, shortages in skills and practice, and conservatism within the construction industry. These all require cooperation between stakeholders with the support of grants and incentives, standard technologies to encourage training and supply chains, alongside better information to enable developers to understand costs over the lifecycle of the building. With these in place, market forces will begin to shape the business and lower the costs.

Socially, education on the benefits of SHP is crucial, and all stakeholders should work together to provide this, ensuring that occupants understand their roles. The SBMs should take into account the needs of occupants and contribute to local communities, while attempting to make developments affordable and part of the mainstream housing market. Creating metrics and models that capture the true value of sustainable developments and include social, economic and environmental benefits can allow comparisons and help developers justify costs.

With respect to the technical factor, growing the market and spreading awareness of sustainability will encourage manufacturers to invest in innovation and developers to set up training programs. This will also encourage designers and architects to seek qualifications and develop expertise in sustainable developments, becoming active participants in the environment of sustainable businesses. At present, costs for technology can be high, but the SBMs and cooperation between stakeholders will see market forces and economies of scale bring prices down.

Implementation of sustainability in the HCI demands harmony and social cohesion in design; however, the occurrence of differences in economic situations and unequal distribution of natural resources continues, in many contexts, to be a major cause of political instability and conflicts. However, all challenges can be overcome with a robust SBMSs framework supported by policies, regulations and standards.

With respect to Saudi Arabia, studies in developed countries have demonstrated that SHPs can be viable and profitable for businesses and homeowners if incentives, such as feed-in-tariffs and legislation, are available to ensure that all companies comply with sustainable principles, creating a level playing field.

Because Saudi Arabia has undergone rapid modernisation over recent years, the above examples, and many others, provide a useful sustainability template for the country. Many challenges have blocked wider uptake of SHPs in Saudi (Mosly, 2015). Such challenges need to be better understood and, although there is an increasing body of research into SHPs in developed countries, these do not always apply fully in the Saudi Arabian context. Culture, economy, environment and politics present unique challenges, so identifying these barriers before developing a SBM is crucial.

2.1	2.2	2.3	2.4	2.5	2.6	2.7
Introduction	Sustainable Development Agenda	Sustainability Agenda in Housing Construction and Best Practices	Sustainable Housing Practices PESTEL Analysis	Sustainability Agenda in KSA Housing Construction	KSA Sustainable Housing Practices PESTEL Analysis	Summary

2.5 Sustainability Agenda in the Saudi Arabian Housing Construction Industry

The benefits of SHPs appear to be important in terms of housing construction businesses, especially if one considers that SHPs can ensure preservation of a country's residents' quality of life and resources for future generations, minimising present and future housing energy demands. Housing comprises 51.2% of the built environment, which in total accounts for 80% of national electricity consumption (Asif, 2016). The growing population in the Kingdom of Saudi Arabia has prompted the assumption that by 2050, housing energy demands will have reached 120 GW; meeting this would require 8 million barrels of oil per day.

The need for SHPs becomes even more apparent if one considers the current housing crisis (Al Surf et al., 2013). In Saudi Arabia the housing shortage will reach an estimated 2.3 million by 2020 (Alrashed & Asif, 2012; Asif, 2016). The increased demand is further exacerbated by population demographics, because Saudi Arabia has a young population, with two-thirds under thirty years of age. These younger generations want to raise families and will need homes. In response to the demand, the Saudis have set up the Ministry of Housing (MOH), recognising that this growth in demand and the resulting construction boom needs coordination (Alrashed & Asif, 2012). The other issue is that this growth in the HCI has seen greenhouse gas emissions from Saudi Arabia rise sharply (Mosly, 2015). Crucially, a new approach must respond to climate change and enhance preservation of the country's natural and economic resources.

The growing demand for new roles to implement sustainability arises from a royal decree made in 2014, requiring all companies to comply with new standards in air, water and pollution. The benchmarks set out in the royal order comply with the US Green Building Council's LEED system of certification, and BREEM in the UK (Taleb, 2011). Both assessment tools are well known and used as rating systems around the world when completing sustainable building projects. The aim when defining sustainable buildings is to create a set of measurement standards to promote environmentally sustainable design, construction and operation of buildings and neighbourhoods.

In respect to sustainability, Saudi Arabia has made progress. Since 2014, it has attained a 15% share of the 1,170 (approximately) buildings in the Gulf Cooperation Council countries accredited with the United States LEED (Asif, 2016); the most prominent example of such a building is the King Abdullah University for Science and Technology (KAUST), located near Jeddah, which was accredited with LEED in 2009 (Taleb, 2011). In addition, the Saudi Green Building Forum (SGBF) has supported investments of more than US$26 billion for use in the construction of about 76 green building projects. The most famous of these projects is the King Abdullah Financial District, which constitutes the largest green building development in the world, with a gross site area of more than 1.6 million m2 (Asif, 2016). Saudi Arabia's investment in green buildings is currently the 3rd biggest investment in the world as the country endeavours to become a world leader in such practices (Wogan, Carey & Cooke, 2019). The outcome is a dramatic increase in the living standards of its residents, preserving the country's natural resources and laying out plans to reach sustainable urban development.

With respect to SHP in particular, which is the focus of this research, the King Abdullah Petroleum Studies and Research Centre (KAPSARC) (a residential community with mixed-used buildings, including the KAPSARC institution and 191 single family homes), has already, since 2012, delivered 82 villas, accredited with LEED Gold (Landreneau, 2012). It has to be noted, however, that no other house accredited with LEED or with other green rating systems, such as the UK's BREEAM or the Middle East's Pearl Rating System (included in the Estidama program), was found during the course of this study. This indicates that sustainability has not yet been adequately incorporated into routine SHPs in Saudi Arabia, probably because of the obstacles and barriers associated with the implementation.

Existing practices show that 70% of the construction industry and building practices have no thermal insulation. To eliminate such practices, in 2010, the Saudi Energy Efficiency Centre SEEC was established, and it became mandatory for thermal insulation to be installed in all new building constructions. Notably, thermal insulation is also required by the Saudi Electricity Company (SEC), whenever an application for electricity connection is made (Asif, 2016), thus improving indoor environments and providing protection from exposure to air pollutants.

Furthermore, the Presidency of Meteorology and Environment (PME) has given all construction companies a 5-year period (from 2014) to comply with both the country's own, and international water, air and noise pollution standards (Asif, 2016). Additionally, the Ministry of Municipal and Rural Affairs has issued a royal decree, in collaboration with the United Nations Human Settlements Programme (UN-Habitat), to implement the Future Saudi Cities Programme ('Future Saudi Cities', 2016), which aims to deliver sustainable urban developments in 17 of the country's regions, guaranteeing satisfactory housing units for all citizens ('UN-Habitat for a Better Urban Future', 2016), thus confirming Saudi Arabia's strong commitment to achieving the 2030 Agenda for SDGs and taking an innovative approach to aligning the 2030 Agenda and Saudi Vision 2030.

Moreover, in 2015, Saudi Arabia adopted the 2030 Agenda for the SD, comprising the following 17 SDGs aimed at ending poverty, combating discrimination and injustice, and dealing with climate change by 2030, as cited in the SDGs report (2016). While the environmental domain focusses on protection of ecological systems, the societal aspects address issues such as planning, layout and design of houses to create a community spirit to self-actualise and enjoy a good quality of life. The objectives underlying SD must be implemented at all stages of the building process. Therefore, the principles of sustainability should be incorporated into all designs and taken forward to the construction stages to realise the concept. The challenge of guaranteeing SHP is among the greatest that mankind has ever faced; it is one requiring collaboration between consumers, housing service providers and the government. Creating a shift in mind-sets is a key agenda for developers, professionals, builders and owners. Therefore, it is important to note a SHP is a process that involves a planning, design and construction phase, during which careful consideration of social (basic amenities) and environmental services must take place under the scope of SD.

Finally, in the Vision 2030 plan for HCI, the economic plan advocates development of sustainable and affordable homes, using local materials where possible, and prioritising natural/renewable resources. The plan also suggests that the methods used to build homes should follow historical building practices and use existing skills. The plan was ratified in 2016 and, at present, government departments, engineering bodies and other stakeholders are developing plans for implementation (Al Surf & Mostafa, 2017). It covers all aspects of SHPs, from working with construction companies to helping potential homeowners access financing figure (2-1).

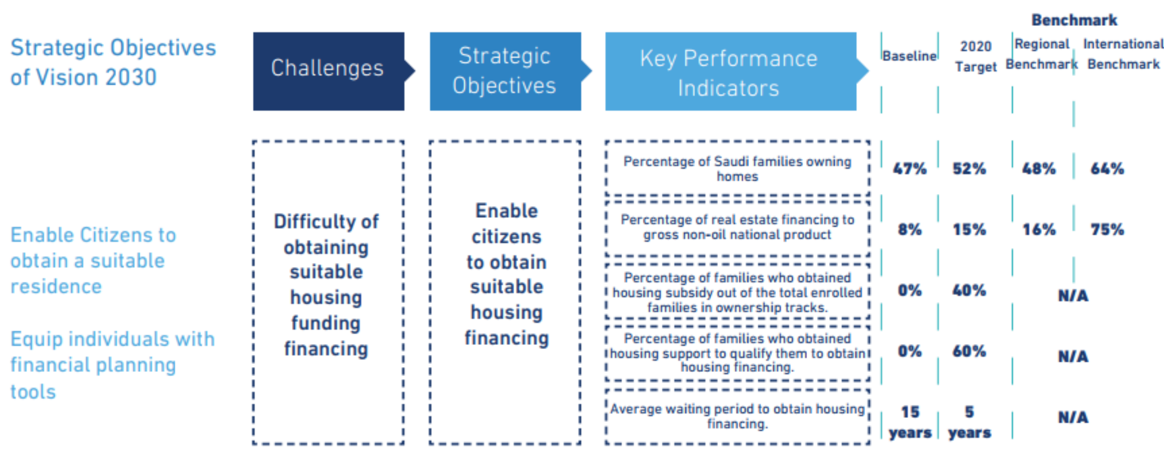

Fig 2-1: 2020 Goals for SHPs adopted from Vision 2030 (2016):

The NTP 2020 ensures that rapid urbanisation in the country will be sustainable and planned for the long term rather than continuing the previous focus on quantity and speed. The government has also encouraged civil development where the public, via NGOs, can partake in civil discourse concerning urban development. This will help to educate the public, encourage training, and invest in the rich human capital within the country. Vision 2030 understands that improving use of human capital is at the core of the plan, and calls for industry councils to determine the skills needed in each socio-economic sector and expand vocational training, while linking public and private sectors for maximum efficiency (Al

Surf & Mostafa, 2017; Vision 2030, 2016). The application will improve the country's economy and business environment to make it more competitive.

2.5.1 Vision 2030

Although developed countries provide a useful roadmap for SDGs, especially with respect to construction and housing, a major difficulty exists. Much of the housing stock contains a large proportion of older housing. Accordingly, any plans for new sustainable and zero energy practices in the HCI focus on a relatively small market segment, and policies often involve application of sustainable principles to historical buildings and houses, which can be technically difficult and expensive. In contrast, for developing countries, there is an opportunity to implement sustainability in the large number of new buildings needed to service a growing population (Surf & Mostafa, 2017). This can help a government fulfil its environmental goals without relying on expensive retrofitting; an idea that is supported by the Saudi Arabian Vision 2030 Plan.

The Vision 2030 initiative is a good example of a governmental initiative and a series of policies that allow construction companies to follow sustainable principles while the country is pouring investment into economic diversification and meeting the housing needs of its growing population. Vision 2030 is a reform plan that understands the rapid changes and modernisation needed to help Saudi Arabia meet the local and global challenges brought about by globalisation and technology.

Overall, the far-reaching plan is a series of economic and social reforms that will move Saudi Arabia away from economic dependence on hydrocarbons and state investment. Instead, the government intends to create an economic environment in which the state, private sector, and NGOs develop goals and commitments that will help the country achieve this economic diversity. Sustainable development is a central element of the plan. Some of the targets in Vision 2030 include (Al Surf & Mostafa, 2017):

- Diversifying by developing non-oil sectors of the economy
- Increasing the non-oil government revenue from SR163 billion to SR600 billion by 2020, and to SR1 trillion by 2030

- Increasing the GDP contribution of the private sector from 40% to 65%
- Increasing the country's share of non-oil exports within the non-oil GDP contribution from 15% to 50%.

Vision 2030 is already underway via the National Transformation Plan 2020, which is seeking to improve the efficiency of the economy, increase taxation, reduce government spending and extend the role of the private sector.

2.5.2 National Transformation Program 2020

As a preliminary stage to achieving the goals laid out in the Vision 2030 plan, the Saudi government has initiated the NTP 2020. This program has established over 24 new government ministries in its first year and has laid out several interim targets that should be achieved by the end of 2020 (NTP, 2016). The program includes annual reviews of progress and will focus on challenges and solutions, planning, performance evaluation and involving private sector enterprises. The NTP 2020 plan has four main pillars (Surf & Mostafa, 2017; Vision 2030):

- Privatisation
- Governance
- Investment in human capital
- Economic diversification

In other words, allowing the private sector to flourish requires investing in people through education and training. As a model for this, the government has looked towards countries with few natural resources that have developed high skill, knowledge-based economies, such as Japan and Taiwan, which achieved this in a relatively short time (Al Surf & Mostafa, 2017; Vision 2030, 2016). This is based upon the understanding that Saudi Arabia's rapid modernisation has focussed almost exclusively on the oil sector and the education system, and inadequate incentives have created a population lacking many of the skills necessary to break away from dependence on fossil fuel wealth.

One crucial aspect is that the plan does not require significant investment by the government, but merely requires organisation to promote cooperation and ensure that all sectors work together and direct funds and efforts to where they will be most effective, helping to achieve the goals of the 2030 plan (Al Surf & Mostafa, 2017). Accordingly, to support the four pillars of the NTP, the government has several additional sustainable strategies that involve 24 government agencies, of which four agencies plan sustainable strategic objectives that are expected to be launched before 2020. The sustainable strategic goals are classified below:

- Ministry of Finance (MOF), objective 5: Achieving sustainability of public debt
- Ministry of Economy & Planning (MEP), objective 6: Activate the environmental dimension as a pillar of SDGs
- Ministry of Municipal and Rural Affairs (MOMRA), objectives 2 & 3: a) Achieve sustainable and balanced urban development and improvement of the level of quality of life in cities and regions of the Kingdom; b) Achieve increasing levels of financial self-sufficiency and high-quality, sustainable institutional performance
- Ministry of Environment, Water and Agriculture (MEWA), objectives 1 & 5: a) Contribute to ensuring sustainable food security for the Kingdom; b) Develop sustainable highly efficient production systems for plants, livestock and fishery, and increase the value added of these target products to contribute to the diversification of the Kingdom’s production base

In addition to these objectives, the program’s strategic objectives have established further sustainability initiatives across the governmental agencies. It is proposed that these actions will be achieved on or before the end of 2020. The Ministry of Justice has assigned a budget of $28,511 to establish a sustainable alimony fund, and likewise, a budget of $20,758 to develop a national planning standard and regulations, based on international sustainable development practices, has been allocated by MOMRA. Also, the Ministry of Environment, Water and Agriculture (MOFA) has budgeted $61,436 to fight desertification and ensure sustainable development of forest and pasture, while a budget of $111,388 has been allocated to manage the Kingdom's national parks sustainably. However, the sizeable sum of $420,973 has been assigned by the Ministry of Education (MOE) to achieve life-long sustainability learning.

Based on the above, it appears that Saudi Arabia is still in the early stages in the application of sustainability in the HCI, especially if one considers that explicit SHPs are under-developing. Moreover, it is crucial that any practices are viable and result in the building of properties that are socially and environmentally suitable. Thus, any business in the future must account for the close relationship between the three dimensions of sustainability: economic, environmental and social.

2.5.3 Environmental Sustainability in Saudi Arabia's HCI

A growing body of evidence suggests that anthropogenic greenhouse gas emissions are causing climate change (Karl and Melillo, 2009). Accordingly, it is important to slow this process for the benefit of future generations. SHPs will play a major role in reducing greenhouse gases by minimising the energy and water consumption of housing stock using climate-responsive designs and materials, green construction, smart technologies and renewable energy. In the Kingdom of Saudi Arabia, population increase and economic growth have fuelled a rapid expansion in infrastructure, especially in the HCI. Unfortunately, compared with other countries, Saudi HCI have rarely considered environmental sustainability (Al-Musa, 2018; Taleb & Sharples, 2011). To add to this issue, the country is one of the driest regions in the world and faces water shortages.

In response to climate change and resource depletion, the HCI in Saudi Arabia prioritises sustainable practices. However, several obstacles slow down the HCI's adoption of environmental sustainability and make preserving natural resources and tackling climate change more difficult. For example, Saudi Arabia's severe water scarcity forces the country to rely on desalination plants, which produce 11% of the world's desalinated water. However, the process consumes high amounts of energy from non-renewable sources (Surf and Saied, 2014). Naturally, sustainable water policies should be a priority for the government because they would also conserve energy. The problem is that demands for water, especially in the HCI, are growing as the KSA's population expands from the current 32.24 million to a predicted 34.94 million by 2020 (Saudi Arabia Population Forecast 2016-2020, 2016).

Climate change is a pressing issue for the KSA, the twelfth largest country in the world with an area of about 2.4 million square kilometres. Because of the prevailing climate and water concerns, the government is now starting to take climate change and resource depletion very seriously. New political initiatives will fulfil the country's obligations under international conventions, including the Paris Climate Accord, the Kyoto Protocol, and the Montreal Protocol.

To support these environmental conventions, the government's core strategy includes the Vision 2030 programme, which lays out policies related to climate change. This will transform Saudi Arabia and reduce CO_2 emissions while making the country more resilient to the effects of climate change. Overall, the plan will ensure that the KSA promotes sustainable development and reduces its dependence on oil (MEP, 2018). Saudi Arabia's economy is heavily based on oil exports (87%), while its state-owned firm, Aramco, is the largest global oil producer and exporter (Saudi Arabia Exports 1968-2018, 2018). Although the country's oil reserves are expected to last for another 70 years, the government intends to reduce the historical dependency on oil and shift towards renewable resources (Dipaola, 2016; Vision 2030, 2016). However, achieving independence from oil is not the most important incentive driving sustainable building practices (Surf & Saied, 2014). Instead, the Saudi government sees an opportunity to achieve additional economic benefits through sustainable housing.

2.5.4 Economic Sustainability in Saudi Arabia Housing Industry

Saudi Arabia's continued economic growth has created significant investments in infrastructure, especially SHPs in urban areas facing high population growth (Taleb, 2011). Several factors influence population growth in Saudi's urban areas, including a rise in fertility rates and migration from rural areas (El-Batran, 2008). In addition, large conurbations attract foreign immigrants, often to work in the construction sector (Timewell, 2011). When set against a background of economic growth and urban investment, this has amplified the infrastructural requirements of cities (Al Surf and Mostafa, 2017). Economic sustainability can become part of this growth, especially with respect to the HCI.

Modern economic sustainability practices aim to maximise income flows while retaining a stock of assets that produce benefits (Said, Osman, Shafiei, Razak & Kooi, 2009). Economic sustainability relates to the financial viability of housing projects, taking advantage of technological advances, innovative building materials and improved housing designs. In particular, for an economically sustainable housing development, the benefits for housing providers and manufacturers should be at least equivalent to housing production costs (Said et al., 2009). The economic sustainability of SHP improves affordability in the long term, since SHPs result in lower energy costs. Housing renovation can also create savings, and the renovation market for energy efficiency upgrades is growing. Many countries now realise the significance of poor energy efficiency within existing building stock and implement policies to address this (Allen et al., 2002). Measures include improving insulation, adding efficient heating and ventilation systems, upgrading lighting, measuring energy consumption more accurately, improving control and management systems, and pursuing renewable energy installations (Xue, 2013). Although the energy savings achieved through sustainable renovation are not as high as for new constructions, such changes are important as energy prices continue to rise (Allen et al., 2002).

Another feature contributing to the economic viability of homes, benefitting owner, manufacturer and user, is the creation of design flexibility to help manage future risks. SHPs often include systems tailored to specific needs, including raised floors and movable partitions so that users can alter the spatial layout without additional costs or disruption (Allen et al., 2002). For homeowners, adaptability supports new uses or redevelopment of sites to meet changing market demands (Xue, 2013). A building with flexibility can adapt to new energy sources, data infrastructure and climate change (Allen et al., 2002). Flexibility ensures that the building will continue to be a valuable asset.

A typical feature of green homes is the durability and longevity of systems. Every material is inspected for its entire lifecycle and for key characteristics at the time of installation. A holistic approach, taking elements of integrated energy, toxicity, emissions, and the cycle of replacement and recycling, ensures that all aspects of a material are sustainable (Allen et al., 2002). Correctly specified sustainable materials and building techniques provide long-term economic benefits, and reduce the need for material substitutions, cleaning and maintenance.

Going a step further, truly sustainable materials can be recycled and recovered at the end of their lifecycle, generating extra revenue, although this process is in the early stages (Xue, 2013). The economic dimensions of sustainability should provide a robust mechanism to ensure adequate prices for target customers by reducing the cost of technology. Economic sustainability and prosperity can also support social sustainability.

2.5.5 Social Sustainability in Saudi Arabia’s Housing Industry

Social sustainability is important in Saudi Arabia due to rapid urbanisation, population growth, demographic shifts and economic development (Central Department of statistics-Demographic, 2018). Urbanisation has seen the government adopt the UN Human Settlements Program (UN-Habitat) as part of the ‘Future Saudi Cities Program’, which operates alongside Vision 2030. The Population and Housing Survey of 2017 showed an increase of just over 85,000 households in one year, and an average household size of 5.97. Saudi-occupied dwellings made up almost a quarter of dwellings in some urban areas, and just under three-quarters of Saudi-occupied homes used the public water supply, while 99.8% relied on the public electricity system (EIA, 2014). To account for these conditions, Future Saudi Cities develops environmentally sustainable cities that also promote social inclusion and economic prosperity. The program addresses infrastructure needs and quality of life, while producing environmental benefits such as reduction of pollution. The program will also increase the proportion of Saudi-owned homes and meet social needs with entertainment, amenities and improved services (MEP, 2018).

Important elements of social sustainability include welfare, social needs and community sustainability, sometimes described as social wealth, social capital, social cohesion and social interest. However, this social dimension is difficult to translate into individual projects because social sustainability is inherently ambiguous (Boström, 2012). Sustainable communities can improve society by offering fairer income distribution, equal employment rights, education, health, and quality of life. Socially sustainable neighbourhoods also promote well-being, culture, social interaction, social order, environmental quality, amenities, safe neighbourhoods, attractive surroundings, social wealth and community participation (‘Creating Strong Communities', 2016). These are context dependent and shaped by localised social and cultural norms.

Sustainability issues in contemporary society are broadly natural and social. A truly sustainable business must address the ‘natural case’ for corporate sustainability and add the ‘societal’ case. According to Opoku and Jordan (2004), each individual or organisation has a set of values and preferences that reflect the social and cultural environment. However, in the case of Saudi Arabia, certain barriers hamper social sustainability in housing developments, especially lack of awareness of SHP and the culture of high initial cost and long payback-time, which conflicts with the local population’s economic situation (Mosly, 2015; Saied Al Surf et al., 2013). In addition, compact SHPs conflict with local culture, in which many generations live under one roof and segregation of males and females within the house demands extra rooms (Saied Al Surf et al., 2013). These cultural and societal preferences are not insurmountable but will shape social sustainability.

Vision 2030 attempts to give nationals the security of home ownership, but many areas suffer from housing shortages, especially for affordable dwellings. In contrast, urban areas in the country are often undeveloped, creating investment opportunities. At present, the housing shortage creates societal problems, especially with demographic shifts towards a younger population who will want to buy affordable family homes. At present, only 50% of Saudis own their homes, and the country needs to build between one and two hundred thousand homes every year. Accordingly, Vision 2030 hopes to include financial support for buyers, but Saudi Arabia has a waiting list for over one and a half million homes. The government has pledged at least a million homes over the next five years and intends to restructure the planning procedures to attract private and foreign investment that could exceed $100 billion. The plan ensures that this invested capital circulates in the national economy, using local expertise and suppliers. The program also recognises Saudi Arabia’s ability to become a knowledge centre for the Middle East, East Africa and Europe. The country can export technological innovation, financial models, processes and designs. With a coherent sustainable business case, the country can profit from supply chains, PPIs, and innovation centres that tap into the global marketplace. However, there are barriers affecting demand, supply, planning and regulation, such as financing for developers and homebuyers. Other problems include restrictions on the proportion of affordable social housing built by local real estate developers. These issues require more cooperation between different governmental sectors alongside regulations to ensure that developments include affordable housing.

2.5.6 Summary

To summarise, SHPs requiring minimum initial investment of just over 2% of the construction cost of conventional practices will yield savings of more than ten times the initial investment, based on a 20-year lifecycle (World Green Building Council, 2013). This figure includes savings from increased productivity and improved health of users, additional energy savings, operating costs, and insurance costs associated with sustainable building design and construction. The extent of any savings is approximate and will vary, depending on variables such as energy prices in a given location (Xue, 2013). Hence, these factors have led researchers to explore the business model case for sustainability in the HCI.

The key question asked in relation to this is: 'How can established HCCs manage a fundamental change in their business models and adapt to sustainability in their business models, improving environmental, social and economic performance?' The SBMs are best achieved when the motivation to effect transformation is compatible with economic interests (Esty & Winston, 2009). The road to such SBMs must be addressed so that HCCs can achieve SDGs that will drive futuristic and long-term growth. Certainly, in the Saudi Arabian context, Vision 2030, by focussing on localisation, attracting investment, developing expertise and supply chains, and becoming a hub, fits these goals.

The emergence of a new BM for housing development has immense potential in the global marketplace. Until recently, the economic factors associated with sustainability had focussed only on housing construction and foreseeing stable growth over time (Miller, 1999). The market needs SBMs that demonstrate the benefits of adopting sustainability principles in business practice. SBMs should emphasise the economic and social benefits and show how to add value throughout the entire model by developing supply chains, attracting money into local economies, and ensuring that sustainable developments include amenities and social benefits. This will raise the quality of life for occupants, build strong and interdependent communities, and help the Saudi government tackle potential social problems caused by demographics, lack of affordable housing and rising income inequality.

2.1	2.2	2.3	2.4	2.5	2.6	2.7
Introduction	Sustainable Development Agenda	Sustainability Agenda in Housing Construction and Best Practices	Sustainable Housing Practices PESTEL Analysis	Sustainability Agenda in KSA Housing Construction	KSA Sustainable Housing Practices PESTEL Analysis	Summary

2.6 Challenges of Sustainable Housing Practices in Saudi Arabia – PESTEL Analysis

As yet, Saudi Arabia has not fully adopted the idea of SHPs, partly due to issues within the industry and partly due to a lack of application across the business sector and amongst the general public (Alrashed & Asif, 2012). Accordingly, although Saudi Arabia is wealthy, it has a very low proportion of certified eco-buildings within the existing housing stock. In addition, there is no national standard, and the country largely uses the US LEED system (Mosly, 2015). The LEED standard was chosen because the country, as shown by Vision 2030, is actively promoting SHPs and needed a ready-made standard. LEED is well-tested and well-supported in the literature and among housing professionals, making it an optimal choice for the task.

The country must face many challenges to achieve a wider uptake of SHPs (Al-Jamea, 2014; Al-Shaalan et al., 2014; Mohammed Saied Al Surf et al., 2014; Alrashed & Asif, 2012; Anica Landreneau, 2012; Asif, 2016; Dipaola, 2016; 'Future Saudi Cities', 2016; Mosly, 2015; Mohammed S. Al Surf & Mostafa, 2017; Mohammed Saied Al Surf, 2013; Taleb, 2011; Xue, 2013). Such challenges must be better understood and, although there is an increasing body of research into SHPs in developed countries, these do not always apply fully in the Saudi Arabian context. Culture, economy, environment and politics present unique challenges, so identifying these barriers before developing a new model is crucial.

Understanding the challenges will allow companies and other stakeholders to develop remedial solutions and mitigations that can support sustainable implementation. Importantly, they will allow the organisations to thrive and take advantage of sustainability, turning it into an opportunity rather than a legislative burden. It also requires cooperation, because a company alone cannot shape SHP, which requires legislation, political support and public education about the benefits (Mosly, 2015). Recent developments, such as Vision 2030, show that the government is actively supporting the private sector, so a housing construction organisation can be more confident that a sustainable approach would now be an inherently viable business proposition.

For this section, PESTEL is walkable and can cover local planning regulations alongside global environmental treaties. It can deliver a comprehensive summary of all the factors that will affect sustainable development in Saudi Arabia, thus providing a useful analysis of the situation and the economic and environmental contexts, while exploring the often-complex links between society, government and the private sector. Based on the PESTEL analytical framework, table (2-3) presents the major challenges and highlights some of the relevant literature describing them.

Table 2-3: Key Challenges to SHPs from international practices and Saudi context

Challenges matches from International Context					Challenges from Saudi Context								
PESTEL Categorises	Key challenges	(H. M. Taleb & Sharples, 2011)	(H. M. Taleb, 2011)	(Alrashed & Asif, 2012)	(Landreneau, 2012)	(Saied Al Surf et al., 2013)	(Mohammed Saied Al Surf, 2013)	(Al-Jamea, 2014)	(Al-Shaalan et al., 2014)	(Mohammed Saied Al Surf et al., 2014)	(Mosly, 2015)	(Asif, 2016)	(Mohammed S. Al Surf & Mostafa, 2017)
Political	lack of a clear and consistent definition for SHPs					√	√						
	Lack of government support	√		√		√	√			√	√	√	
	Inexpensive electricity (reasonable)	√	√	√			√		√		√	√	
	Lack of support within the industry environment					√							√
Economic	High upfront and initial costs					√	√						
	Affordability						√						√
	Lack of financial incentives and grants					√	√				√		
	Long term payback on investment (not convincible)		√	√		√	√				√		√
	High land cost and low availability					√	√						
Social	Lack of awareness about sustainability	√	√	√		√	√				√		√
	Hard to achieve the privacy concept			√		√	√						√
	Hard to ensure security			√				√					
	Acceptance, interest, believes			√		√	√	√			√		
	Rapid growth of the country	√	√	√		√	√	√		√		√	√
	Education about sustainability			√			√						√
	User behaviour			√									
	Hard to meet demand							√					

	Inaccessibility					√	√	√					
Technological	Shortage in sustainable practice			√		√	√				√		√
	Adoptability and flexible design		√	√		√	√	√			√	√	
	Lack of local materials or single supplier for materials			√		√	√				√		√
Environmental	Climate change	√	√	√	√		√		√	√		√	
	Water scarcity	√	√	√	√	√	√			√		√	√
	Electricity demand	√	√	√	√	√	√		√	√	√	√	√
	Natural resource depletion	√	√	√			√			√	√	√	√
Legal	Weak of definitive regulations					√	√			√	√	√	
	Non clear regulation from Saudi energy efficiency centre program										√	√	
	Not clear Saudi building code	√					√					√	
	Lack of green building code						√				√		

The table above presents the challenges facing SHPs in Saudi Arabia. The major challenges appear at the environmental and social aspects. The country is suffering from being afflicted environmentally by a harsh climate and is also afflicted by high consumption of non-renewable resources. Beside that the country is facing affordability and availability problems in housing. Awareness about sustainability either because of education or because of the culture of “Sustainability Cost More” is appearing in the major challenges. Also, the table shows that accommodating the conservative Saudi customer is quite challenging because of their specific requirements the housing design. In review, concerning these aspects and more, it has become clear that it is necessary for politics and governmental bodies in to introduce and urge a clear green building codes and regulations, as well as implementing country customised accredited sustainability rating systems.

2.6.1 Political Challenges

The political challenges in the PESTEL analysis covers policies and regulations at every level, from global environmental treaties down to local planning regulations. Political challenges include absence of clear definitions for sustainability within HCI, inexpensive electricity, and inadequate support from both the government and housing construction supply chain. It also assesses how governments shape economic conditions and can include policies affecting physical infrastructure and those influencing health and education. Some of the more important issues affecting the political factor in Saudi Arabia include:

- **Lack of a clear and consistent definition of SHPs**

One important issue within the political factor is the lack of a consistent and workable definition for SHPs. As an example, Saied Al Surf et al. (2013) identify over 300 different definitions of sustainability. Without a more precise definition, it is difficult to implement a consistent approach, and imprecise definitions leave room for less scrupulous developers and legislators to build homes that are sustainable in name only. For example, in 1987 the World Commission on Environment and Development's (WCED's) definition argued that sustainability means satisfying present needs without safeguarding the needs of future generations. While a useful definition, it is not sufficiently specific for use with sustainable housing.

Phillis (2001) agrees that current definitions are inadequate, pointing out that academia has not delivered a commonly accepted definition or consistent metrics to measure sustainability. Miller and Buys (2013) take a different perspective and argue that many definitions are too specific: much of the research into SHPs focusses narrowly on energy efficiency programs and largely ignores the other important aspects of sustainable construction. As noted by Birkeland (2008), future research into sustainable building must include cultural aspects and climate. As an example, a home should also support social networks, the wellbeing of individuals and families, and the ability for inhabitants to be self-supporting (Saied Al Surf et al., 2013). Clearly, a new definition for sustainability that includes society and culture, especially within the context of the HCI, is necessary.

Returning to the WCED (1987) definition, while too broad, this does form a starting point where sustainability encompasses property developments that will provide present generations with a good quality of life without compromising quality of life for future generations. The easiest way to approach this is by linking three cornerstone factors covering the environment, economics and socio-cultural contexts. Individual businesses or organisations cannot achieve this alone, and it is impossible to create a useful definition if different sectors apply their own perspectives. Helping the industry to incorporate sustainability requires cooperation between multiple stakeholders, including political actors, the private sector and academic institutions, in order to develop a working definition that covers all eventualities (Mohammed Saied Al Surf, 2013). Understanding exactly what the term SHP covers allows policymakers and businesses to explore the technologies and better understand the benefits.

- **Lack of governmental support**

Governmental support is a crucial element for creating SDs, because strong policies create a background that encourages stakeholders to participate. In Saudi Arabia, despite the successes of the National Energy Efficiency Programme (NEEP) and other governmental policies, governmental support can be fragmented and narrow, creating a need for a wider and more holistic programme for sustainable building (Alrashed & Asif, 2012). For example, to support sustainable building regulations, the government could offer incentives to support energy efficiency and renewable generation, offsetting the low prices and feed-in-tariffs (Asif, 2016). In many ways, policies and government support create ties between stakeholders and ensure that everyone follows a common purpose and works together to develop solutions.

- **Inexpensive electricity**

Inexpensive electricity can affect sustainable development by reducing the benefits of SHPs and extending payback times. This is particularly true in Saudi Arabia, where cheap electricity creates a barrier to development of energy efficient houses by affecting feed-in-tariffs (Alrashed & Asif, 2012). Although energy prices have risen threefold over the last 10 years and continue to increase every year, electricity in the country is still much cheaper than in developed countries due to government subsidies for householders (Alyousef & Abu-ebi, 2012). This creates two problems: firstly, the low cost removes the economic incentive for energy efficiency, because occupiers are less likely to receive sufficient payback for the initial investment costs. As an example, the low tariffs mean that only 16% of homes in Saudi Arabia have thermal insulation fitted to external walls, despite the extreme climatic conditions. Secondly, the low FiT means that occupiers will make less money from selling surplus electricity from renewable systems (Alrashed & Asif, 2012). Although the solar potential in Saudi Arabia is high, limited opportunity for making money reduces the impetus for installing renewable systems.

- **Lack of support within the industry environment**

Across Saudi Arabia, some sectors of the building industry have been slow to support SHP policies, despite regulations specifying otherwise, and this has slowed progress significantly. For example, a survey covering commercial buildings, commissioned by the Saudi Electric Company (SEC), suggested that only 15% of new commercial buildings have been fitted with the mandatory thermal insulation, and only 580 out of a total of 15,000 new buildings include additional applied thermal insulation. Some parts of the country, such as Jeddah, face even lower levels of compliance (Asif, 2016). In a country with a climate like Saudi Arabia's, thermal insulation is an essential element of SHP to reduce energy usage. This suggests that the industry, at present, does not support even the simplest of sustainability initiatives. Part of this is due to lack of financial incentives and perceived low profitability of SHPs, which is an issue requiring business solutions.

2.6.2 Economic Challenges

The economic challenges describe any economic issues that could influence SHP policies and includes challenges such as high upfront costs and absence of financial incentives and grants. This may suggest that the payback time is too long, not convincing or covers high land cost and low availability. All of these can affect the practices of SH and, due to the long lifecycle and payback, longer-term solutions are required. The main economic challenges affecting SHPs include:

- **High upfront and initial costs**

One of the basic principles of SHP is that it may cost more initially, but occupants make money from selling renewable energy, eventually breaking even or even profiting. The idea that the technologies and other systems installed in sustainable buildings have high upfront costs is rarely countered by research, but is it possible to reduce these costs and make sustainable solutions more attractive? (Mosly, 2015; Mohammed Saied Al Surf, 2013). Many experts agree that much of the upfront cost is incurred by transporting materials from abroad rather than using locally manufactured components common in traditional construction. Accordingly, this raises the initial costs and may be one reason why the uptake of sustainable building practices in Saudi Arabia is relatively low. Developers and purchasers are reluctant or unable to both absorb these costs and remain profitable. To add to the cost of importing sustainable materials, lack of expertise means that many contractors are unfamiliar with new systems, so progress will be slow and more costly. Inadequate knowledge also means that a development will need many corrections and changes, again costing time and money (Mosly, 2015). In other words, lack of expertise and experience in sustainable building in Saudi Arabia contributes to high initial costs (Mohammed Saied Al Surf, 2013). Developing local expertise and encouraging industry to manufacture products would overcome this, but financial support is necessary to encourage risk, alongside investment in skills and creation of markets.

- **Affordability**

Although Saudi Arabia is considered a relatively wealthy country, high house prices mean that many Saudis wanting to own a home cannot afford to buy anything suitable, especially considering the need for space. This economic problem is another barrier to the uptake of SHPs because the additional upfront cost pushes many beyond their means. According to Opoku and Muhmin (2010), the mean gross per capita income for men in 2007 was 7,166 US$ and much lower for women, meaning that few Saudi families can afford to buy a home large enough for multi-generational occupation. However, many young families now choose to live in a separate, smaller home, which has increased demand and prices in that real estate sector, creating shortages (Mohammed Saied Al Surf, 2013); There is, therefore, a demand for both large homes and for small, affordable homes for small families.

In 2011, Saudi Arabian rulers suggested a plan to create half a million homes within a few years, partly due to protests in neighbouring countries and a realisation that investments in social support were needed (Dokoupil & Rashad, 2013). However, as is often the case with royal decrees, progress has been slow, largely because of the shortage of suitable building plots for such large developments. In 2013, another decree announced a multi-billion dollar program to tackle this housing shortage by releasing vast areas of state-owned land for development and by stimulating the construction sector (Dokoupil & Rashad, 2013). Ultimately, it is important to bridge the gap between supply and demand by catering for the young demographic in the country and addressing the rising need for affordable homes. Price reductions would leave scope for incorporation of sustainability, bringing sustainable homes within the financial reach of Saudi families (Assaf, Bubshaitr & Al-Muwasheer, 2010; Mohammed S. Al Surf & Mostafa, 2017). Overall, the rapid Saudi population growth increases demand, and only a house-building program can alleviate this, as well as making SHPs more affordable.

- **Lack of financial incentives and grants**

Financial incentives can overcome some of the issues relating to high upfront costs and encourage businesses and homebuyers to invest in SHPs. The Saudi government could be more proactive in providing incentives to improve the overall thermal performance of new homes or offset the low payback for feed-in-tariffs, which could address the poor uptake of the concept and increase public support. Over the longer term, such policies could be beneficial and deliver a governmental return on investment by supporting low carbon technologies and creating a self-supporting low carbon economy (Asif, 2016). Because SHPs create savings elsewhere, through reduced environmental degradation and the reduced need for infrastructural investment, this will not add to the level of government spending. Following a core tenet of Vision 2030, SHP could simply benefit from an improved linking of public and private sectors.

While there is little specific data predicting the long-term benefits to the Saudi Arabian economy of SHPs, on a worldwide scale it is estimated that a low carbon economy would benefit the global economy by $2.5 trillion a year by 2050, with the market for low carbon technology estimated to be at least $500 billion (Asif, 2016). Overall, sustainability is no longer the sole preserve of environmentalists and has become part of the value chain inherent within building projects (Abdellatif, 2006). This conforms with the goals of the Vision 2030 plan by helping to diversify the economy and create jobs outside the oil industry. It could support supply chains that stretch from HCCs to suppliers and local manufacturers.

Many countries offer significant financial incentives to support SDGs for new homes or retrofitting of old buildings to fulfil environmental regulations. Over time, this may disappear, and legislators will, instead, adopt punitive measures for those not complying, so early adopters should take advantage of the incentives (Alrashed & Asif, 2012). For example, as the market for SHPs grows and matures, with a greater number of projects, the government may find it expensive to maintain the level of incentives and could reduce them or remove them altogether. This happened in the UK, for example, with a reduction in the level of FiT for solar installations (Cherrington, Goodship, Longfield & Kirwan, 2013). Plans should be flexible enough to adapt to such changes in financing and be temporary. This should help the sustainable housing market grow until it becomes large, self-sufficient, and profitable.

- **Long-term payback on investment (not convincible)**

Long-term payback is crucial for SHPs and encourages potential homeowners to spend more money on the premise that they will see a return on investment. Governments could also receive payback, so they could pass these onto developers and homeowners. The Saudi government understands the long-term benefits of SHPs, especially with regard to lowering demands on energy delivery infrastructure (Susilawati & Al Surf, 2011). For example, SHPs, through energy efficiency and renewable power, can reduce overall demand on the electricity infrastructure and lessen the need for expensive upgrades and repairs (NEEP, 2017). The government will be able to postpone expensive increases in power plant capacity with the associated environmental damage from operation and construction (Asif, 2016). This is an example of a wider approach to infrastructure development, in which investments in SHPs reduce the need for investment elsewhere. Naturally, the issue for private HCCs is ensuring that they receive the benefits of these savings via incentives.

- **High land cost and low availability of lands**

One of the major issues facing SHPs in Saudi Arabia is the increasing price of suitable land for building. Because planning and freeing up land is often a local issue, municipal governments are as influential as national governments in supporting sustainable housing development. In Saudi Arabia, identifying the main stakeholders is part of the process of gradually implementing sustainable policies and tackling the problem of increasingly expensive building plots. In the country, this is one of the main barriers to sustainable construction, especially when allied with the high initial building costs, quickly pushing sustainable houses beyond the financial means of many potential buyers. One possible way of overcoming this is by creating Private-Public Partnerships (PPPs) to spread costs and risks

(Al Surf, 2013). Of course, this will require policy and planning support from national and municipal governments.

As an example of the way policy can change approaches and encourage action, one issue in the Saudi property market involves absence of property taxes. Without the additional costs, land speculators could 'bank' land, knowing that it would rise in value even if they did nothing with it. As a result, many urban districts in Saudi Arabia have extensive undeveloped areas, adding to the shortage of building land and driving up prices. Half of the cost of house building in the country is eaten up by land prices, as opposed to a third in Europe, and the steep increases in land prices in Saudi has seen housing prices spiralling beyond the reach of many buyers (Fattah, 2013). The introduction of land taxation has discouraged land banking and stimulated development, causing the prices of land and housing to fall (Mohammed Saied Al Surf, 2013). Overall, the economic factors in Saudi Arabia are linked and contribute to higher prices for SHPs, requiring shrewd intervention from government and coordination with the private sector.

2.6.3 Social Challenges

The social challenges capture a wide range of socio-economic and cultural challenges that can influence SHPs, including: lack of awareness of sustainability (public, developers, government), difficulty in achieving the concept of privacy, problems ensuring security, lack of acceptance and interest, beliefs, rapid growth of the country, education on sustainability, user behaviour, difficulty meeting demand, and inaccessibility. Consumers and society can create pressure to change through direct lobbying of government and by influencing the market through demand. The main social issues affecting sustainable housing practices in Saudi Arabia include:

- **Lack of awareness of sustainability (public, developers and government)**

Many of the concepts of SHPs, such as near zero-carbon housing, are very new and relatively unknown within the Saudi Arabian construction sector. There are inadequate empirical studies and case studies to support uptake and inform stakeholders and business owners of the benefits of sustainability (Alrashed & Asif, 2012). For example, the construction industry and the Saudi public are not always aware of even relatively simple energy efficiency measures, such as double glazing, thermal insulation, energy-saving light bulbs, energy efficient appliances, and the relevant energy efficiency rating systems (Alrashed & Asif, 2012). In contrast, the European and North American public understand the financial and environmental benefits and readily accept these measures.

This lack of awareness extends to a restricted understanding of the cost effectiveness of renewable energy technologies and how they create cost savings, reduce maintenance, and promote reliable and resilient power supplies and comfort (Alrashed & Asif, 2012). In addition, occupiers may not know how to optimise the performance of the building for maximum benefits (Asif, 2016). If they do not optimise usage, they may struggle to recover the higher initial costs and may view sustainable housing negatively. Clearly, educating consumers will be part of developing SDs initiatives.

- **Hard to achieve the privacy concept**

One of the main weaknesses in the Saudi approach to SHPs remains lack of support for social and cultural preferences (Al-Jamea, 2014). Across the gulf countries, especially in deeply conservative Saudi Arabia culture, privacy is a much more important concept than in many other cultures. Houses must preserve privacy and modesty as part of the prevalent cultural and religious values, and this provides a major challenge for the development of SHPs in the country. Construction companies, architects, urban planners, social planners and government planning departments have made sure that private quarters are not overlooked by other buildings. In addition, within homes, a Saudi house should have separate sections for guests, the family and the servants.

One problem for home design is that many modern SHPs use large window frontages to capture the sun, maximise natural light, and support energy efficiency. Others use open-plan layouts to promote free circulation of air and heat, without the separate sections needed to maintain privacy. These standard concepts may need adjustment for Saudi houses (Al-Surf and Susilawati, 2011). For example, privacy means that bedroom windows should not face public thoroughfares. Another Saudi preference is the idea of inner courtyards rather than external gardens, because they preserve privacy and provide cooling systems (Al-Jamea, 2014). This links to the lack of expertise within the industry, because consultants brought in from elsewhere to train Saudi companies and fill gaps in expertise will not be used to working within these constraints.

The privacy aspect is particularly pertinent in the Saudi context, where there are many issues with oversight of buildings and the resulting loss of privacy (Al-Jamea, 2014). This issue arose due to poor regulation and enforcement, and absence of robust building regulations governing the design of high-rise buildings next to lower private homes. This can affect local sensibilities concerning the right to privacy in the home and the requirement for modest behaviour in national law and religious guidance (Susilawati & Al Surf, 2011). Going forward, developing robust and inclusive planning processes to avoid such issues must become part of any program to promote SHP.

- **Hard to ensure security**

One aspect of SHP that requires consideration is security, because families want to feel safe in their own homes, which is a priority that often comes before consideration of environment and finance. Another local challenge in Saudi Arabia is the need for security for internal and external spaces, including family areas and children's areas. These areas should be visible and located behind security measures, such as fences and gates (Al-Jamea, 2014). This may be shaped partly by the need for privacy, and partly due to concerns about crime, despite the relatively low crime rate in the country. However, such security measures should not reduce accessibility inside and outside the property.

- **Acceptance, interest and beliefs**

One factor that is unique to Saudi Arabia is the influence of religious beliefs on housing design, which will make transposing design ideas from elsewhere more problematic. Saudi society, politics and culture follow strict Islamic doctrines and influence all parts of society. Champan, Petersen and Smith-Moran (2000) argue that Islam is more than a religion, and that it governs all spheres of human activity, including home life, work, society, education and academia. In other words, the environment and technology derive from the will of Allah as part of creation.

Other beliefs shape culture, especially family life, where many generations live together under one roof, and family elders receive respect (North & Tripp, 2009). With several generations sharing a space and families responsible for caring for the elderly, this shapes housing design, because homes need to be large and suitable for people with mobility problems. These cultural and religious norms have a profound effect on sustainable design and construction because they are a priority in such a conservative culture. This poses problems for single homes, but also for neighbourhoods, because developments must permit social interaction within the context of Islamic teachings while preserving privacy. Consideration must be given to the location of windows and entrances as well as segregating genders within the house. Culturally and historically, many Saudis prefer natural lighting and ventilation in homes, adding additional design difficulties (Abu-Ghazzeh, 1997; Al Hemaidi, 2001; Daneshpour, 2011; Eben Saleh, 2002; El-Shorbagy, 2010; Hamdy, 2001; Mubarak, 1999). This further promotes the need for cultivating local expertise, because non-Saudi designers may not understand these nuances.

A series of interviews suggested that all Saudi stakeholders agree that culture and religion are crucial considerations for housing design (Saied Al Surf et al., 2013). However, while these considerations will make SHPs more difficult, it is likely that many of these religious and cultural factors already influence traditional housing designs, so these skills can be transferred to sustainable developments.

- **Rapid growth of the country**

As a developing country with a young population, this will further affect house prices and affordability in Saudi Arabia. The country is also facing increased urbanisation, resulting in environmental and social pressures as a consequence of overcrowding and allocation of resources in densely populated areas (Abdul Salam, Elsegaey, Khraif, & Al-Mutairi, 2014). Use of technology could maximise the space available on a site to alleviate overcrowding and allow smaller plots to be used. Designs can use natural light and include natural ventilation schemes for cooling and heating. This will maximise energy efficiency and reduce the strain on the local electricity infrastructure (Susilawati & Al Surf, 2011). As a country develops, space restraints and rising land prices may serve to restrict house size, so placing people into smaller areas without sacrificing too much space or straining resources becomes important (Bhatta, 2010). However, failing to take into account the effects of overcrowding on human psychology and society can be detrimental to developments by making them less desirable.

Saudi Arabia's present population is approaching 35 million people, and could double in the next 30 years (Central Department of Statistics-Demographic, 2018). This is already creating housing shortages for low- and middle-income families, and growth will exacerbate this (Al-Jamea, 2014). While SHP is important, it may be necessary to consider high volume developments to build sufficient houses quickly. Not only is the population growing, but the tendency for young families to seek separate homes means that Saudi Arabia may need over 2 million more homes by 2020 (Alrashed & Asif, 2012). Because the Saudi plans for house-building programs are large, multi-year endeavours, designs must be flexible enough to react to demographic changes.

In addition, the number of domestic buildings is growing rapidly and statistics suggest that in order to meet the needs of the rising population the country needs to build 2.32 million new homes by 2020 (Alrashed & Asif, 2012). Of course, large housing developments will further increase social pressures and demands on resources, making sustainability essential.

- **Education about sustainability**

A problem shared with many developed countries seeking to promote sustainability practices in the housing industry, is lack of public awareness about sustainability benefits. Most of the general public believe that SHPs are expensive because they are not aware of the payback potential over time. In other cases, the public are not always aware of the sustainability concept and fail to consider it a priority when buying a home (Susilawati & Al Surf, 2011). Public education is an area covered by the Vision 2030 plan, which could improve public awareness of the benefits of sustainable development and encourage public 'buy in' for the idea.

- **User behaviour**

Modern buildings are becoming increasingly elaborate and require more complicated construction materials and additional energy. This can have implications for the environment, the surrounding society and the national economy. Accordingly, this has increased the need for development of sustainable solutions and promotion of improved use of resources to lower the environmental footprint (Abdellatif, 2006). Although electric appliances and electronics are becoming more efficient, modern households tend to make more use of them, so the need for energy-efficient buildings remains. Technological advancement, especially where related to lifestyle choices and social factors, is an important element of sustainable housing programmes.

As an example, a 1990 survey by the Saudi government suggested that almost two-thirds of the summer electricity load derived from air conditioning (Khair-El-Din, 1991). In 2009, the Ministry of Water and Electricity (MoWE) pointed out that electricity consumption had increased by a third since then; again, largely due to air conditioning. A further study, by Dincer et al (2004), looking at energy usage between 1990 and 2001, also showed that air conditioning was energy intensive, accounting for about half of all usage. Added to this, studies of trends in the construction industry suggest that most building projects are for new homes, a finding supported by licence applications from the Saudi Ministry of Municipal and Rural Affairs (MoMRA, 2011). Developments in the residential sector will increase in future years due to the population growth of 2.5% and the fact that less than a quarter of Saudi nationals own their homes (Deloitte 2010; Alrashed & Asif, 2012). Of course, an increase in the number of residential properties will increase energy demands for air conditioning.

Energy consumption is growing rapidly in the country, with the residential sector accounting for just over half of all consumption (Alyousef & Abu-ebi, 2012). With a growing population, subsidised power and economic growth, demand is likely to continue increasing rapidly and double the 2009 levels by the year 2025 (Obaid & Mufti, 2008). While the country will need to address its generating capacity, Saudi Arabia should also promote energy efficiency and sustainable development to offset and reduce these demands (Alrashed & Asif, 2012). In other words, sustainable design can reduce power demands, but users will have to change their behaviour and become active energy savers.

- **Hard to meet demand**

Across the literature, many studies have focussed purely on the economic and environmental benefits of SHPs and have not taken into account the social and cultural aspects that are shaped by local sensibilities (Seyfang, 2010). Designers may also ignore the user experience and fail to ensure that occupiers are comfortable and feel that their needs have been met and their cultural norms respected (Al-Jamea, 2014). People buying a home generally want it to ‘feel’ right, and no amount of sustainability will encourage them to buy a home they simply do not like.

Focussing on occupier comfort will create support for SHPs and promote benefits more successfully than brochures or academic papers. Instead of trying to sell visions and broad environmental notions, potential buyers will be able to see and sample the benefits, and word of mouth will help to spread the concept. The idea of sustainability will gain additional value, and more people will become aware of the benefits. This will help to overcome the common public belief that SHPs are expensive or unaffordable (Al-Jamea, 2014; Salam, 2002). This is another area where educational principles within the Vision 2030 Plan could be useful, showing the public that sustainability is a positive goal. However, people are often mistrustful of advertising and may prefer to see the promises brought to fruition before they buy into the idea.

- **Inaccessibility**

Within the home, family areas should be accessible to all family members and suitable for the common Saudi extended family structure, which includes children alongside the elderly. All should be able to move up stairs and within building levels with little difficulty, and any outside family areas, such as the entrance and garage/outbuildings, should be visible and equally accessible (Al-Jamea, 2014). Balancing privacy, security and accessibility can be a challenge for building design professionals, adding constraints. However, the emphasis on preserving historical architecture within the 2030 plan and working with traditional techniques means that, to some extent, these concerns will already be addressed because they are commonly catered for within existing Saudi housing styles.

2.6.4 Technological/Technical Challenges

These challenges address technological and technical issues, and includes the impact of technology, adoptability and incentives for adopting new technologies. The factor can also cover areas such as shortage in sustainable practices, problems in the adoptability and availability of flexible designs, and lack of local materials or single suppliers for materials. Some of the main issues affecting the Saudi sustainable housing approach include:

- **Shortage of sustainable practice and construction materials**

SHP requires new skills at all stages, from planning and design through to construction and maintenance. This need for skills extends into developing sustainable components and materials and educating the public, decision-makers and occupants about the benefits. However, in Saudi Arabia, there is a lack of expertise at all stages, and this needs to be rectified if SHP is to become a mainstay of housing policy (Mosly, 2015). Naturally, this will involve the education system, professional training programs, and setting up links with professional bodies and industry specialists in other countries to help develop a pool of expertise and make a career in sustainable housing appealing.

- **Adoptability and availability of flexible design**

Ideally, a SHP design should be flexible and allow future changes. For example, in a country with a strong youth demographic, a design should allow for expansion in the size of the family by increasing the number of rooms or extending the building. Flexible design also means that the initial planning stages should support ongoing adjustments as construction proceeds. This will make it possible to address issues not apparent during design, allow for changes to suit customer preferences, and support future installation of new technologies (Al-Jamea, 2014). This accommodates preservation of architectural heritage, included in the 2030 plan, because it is a way to provide subtle differences in housing that avoid 'identikit' approaches. Homogenous developments can make an area aesthetically less desirable and fail to account for customer preferences. One problem is that flexibility is challenged by the need to build houses quickly in response to rapid population growth. Al-Jamea (2014) argues that Saudi housing design rarely takes into account social and cultural sensibilities. Accordingly, this is an area where sustainable housing needs to improve on present practices.

- **Lack of local materials or single suppliers of materials**

As discussed in the section on economic factors, one way of driving down upfront costs is by sourcing local construction materials to reduce transportation costs. In Saudi Arabia, while sustainable construction materials are available in the country or in neighbouring countries, there is little understanding of these materials and few incentives for manufacturers to grow and increase production (Alrashed & Asif, 2012). Spreading awareness of these materials and showing how they can benefit society and future generations becomes crucial for sustainable business. More Saudis should become aware of the importance of moving away from non-renewable resources to preserve wealth for future generations. At all levels of society, awareness of sustainability, especially in the housing sector, needs to grow (Mosly, 2015; Al Surf, 2013)**.** Spreading awareness of the benefits of sustainable materials and a growth in their use will help local suppliers to expand their market, grow their business and invest in new products.

2.6.5 Environmental Challenges

The environmental challenges cover the prevailing environmental conditions influencing SHPs and includes; climate change, seasonality, water scarcity, electricity demand and natural resources depletion. These affect policy, legislation, and design specifics, and operate on all scales, from global issues, such as climate change, down to local environmental variations. The main environmental challenges for SHPs in Saudi Arabia include:

- **Climate Change challenges**

While it is important to look at SHPs in a Saudi context, it is important to remember the global nature of many of the environmental challenges faced by humanity. Climate change is one of these and, due to geography and climate, Saudi Arabia is particularly susceptible. Accordingly, it is important to spread awareness of climate change in the country and encourage all stakeholders to work towards fulfilling the country's commitments to various environmental treaties concerning the reduction of carbon dioxide emissions. In other words, SHPs incorporates energy efficiency contributes towards improving life for Saudis and for the rest of the world (Alrashed & Asif, 2012). Considering recent protests against climate change, global awareness of the problem is growing, and there is no reason why Saudis should not become environmentally aware.

Encouraging the public and industry to buy in is important, because climate change is largely due to carbon dioxide and methane emissions from fossil fuels. Emissions are linked to energy demand, so an almost 90% increase in demand over a few decades has seen an almost 80% increase in carbon dioxide emissions. As awareness of this link spread, notably in 1987, the 1992 Rio de Janeiro convention and 2011 Durban agreements saw countries begin to make commitments to reduction of emissions (Alrashed & Asif, 2012). Undoubtedly, as a large producer and consumer of fossil fuels, Saudi Arabia will be at the forefront of tackling climate change and can look for alternatives to fossil fuels while diversifying its economy.

In this respect, geography enabled Saudi Arabia to benefit from vast oil reserves, and geography can now help the country to benefit from the renewable energy revolution, allowing the country to remain a major global player in the energy market. Saudi Arabia has a huge potential for solar energy and predictable coastal winds that can benefit wind farms. As noted by Alrashed & Asif (2012), the country has approximately 3250 annual hours of sunshine and the potential for achieving an average of over 2200 kWh/m² with solar panels. The relatively open nature of the country makes it a good option for utility-scale solar farms, so this may make small scale solar panels fitted to homes less appealing when compared with the economies of scale of large arrays (Tsuchida et al., 2015). This will affect the payback time, because owners of sustainable homes will have less opportunity to sell power back to the grid. However, as Tsuchida et al., (2015) note, there are other advantages to smaller systems, such as reducing the strain on infrastructure and reducing the number of people affected by outages. There should be room for large- and small-scale solar systems.

Due to the extreme climate, Saudi Arabia is particularly susceptible to climate change, yet the country performs poorly with respect to emissions. The country occupied the last position in the Climate Change Performance Index of 2018 (Burck, Marten, Bals & Hohne, 2018). Clearly, this is a poor performance, and the country needs to improve its climate change approach, mainly by reducing greenhouse gas emissions from the construction industry. As part of a wider initiative, SHPs can play an important role in this (Taleb & Pitts, 2009). One way in which the country can reduce emissions is by producing half of its power from renewable sources by 2020 (EIA, 2014). This will reduce the footprint and free up gas and oil for export (Mosly, 2015). Over time, as world energy production patterns change and oil demand falls, the country will have time to diversify its economy.

- **Water scarcity**

Water shortage in Saudi Arabia is a major concern, with insufficient available resources to supply the growing population. Many gulf nations draw upon groundwater to supplement supplies in the face of growing demand, but this cannot be replenished. Demand has risen steeply in recent years and, because of the limited supply of groundwater and accessible surface water, methods such as desalination and wastewater reclamation have been common since the 1960s (Susilawati & Al Surf, 2011). However, many gulf nations still use groundwater as a source, due to growing populations and high demand (NSD-D Hub, 2019). Saudi Arabia is an example, using approximately twice the global average ecological footprint per capita, and water scarcity is the reason the nation is regarded as one of the most ecologically threatened countries in the world (Global Footprint Network, 2016). Using water much more sustainably is crucial for reducing both reliance on groundwater and the amount of energy needed for desalination.

In many ways, water scarcity encapsulates the environmental problems faced by Saudi Arabia. A country where overall water consumption exceeds demand is regarded as suffering from water scarcity, and the gulf area has some of the most serious water shortages in the world; lower even than Sub-Saharan Africa (Asif, 2016). Because the use of water far outstrips renewable supplies, Saudi Arabia has had to make up for the shortfall with desalination, which is a very energy-intensive process. On a macro scale, Saudi Arabia has adopted technology such as water desalination; therefore, water recycling and grey water reuse could address localised water shortages (Susilawati & Al Surf, 2011). Table (2-4) and figure (2-2) shows Saudi Arabia is one of the top five nations in the world using water desalination technology, accounting for a quarter of total production. This amounts to 5,253,200m3 per day (Asif, 2016). While the country will always need to use desalination, and some of the electricity demand can be provided by renewable energy, using water efficiently is necessary, which makes water recycling an essential component of SHP.

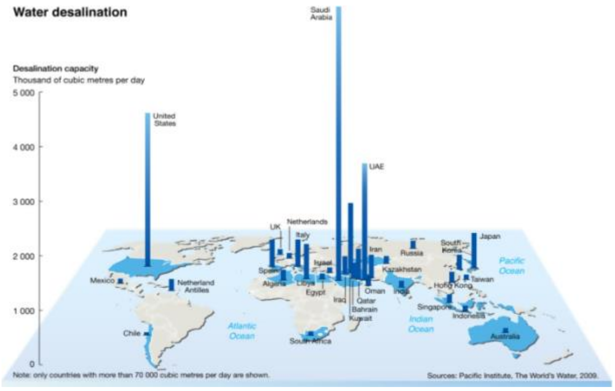

Fig 2-2: Desalination by Country adopted from Gleick et al., (2009)

Table 2-4: Top five countries using water desalination adopted from Asif (2016)

Country	Total production (m^3/day)	% of global production
Kingdom of Saudi Arabia	5,253,200	25.9
United States	3,092,500	15.2
United Arab Emirates	2,164,500	10.7
Kuwait	1,538,400	7.6
Japan	745,300	3.6

- **Electricity demand**

Growing demands for electricity to cope with 21st century technology mean that electricity generation and supply must increase, which can require expensive investment. Tackling this requires demand-side solutions, such as energy efficiency programs and home-based renewable energy. According to the Saudi Ministry of Water and Electricity (Ministry of Water and Electricity, 2009), there has been an increase in demand for electricity over the last two decades of just over 30%, and this is largely due to the wholesale use of air conditioning. Between 1990 and 2001, about half of all residential energy consumption was related to use of air conditioning. Cooking contributes just under one third, and appliances and lighting make up the remainder (Alrashed & Asif, 2012).

The huge demand for energy is a major issue for Saudi Arabia, and the trend is driven by population growth, economic growth and development, technological advancement and wealth, which all lead to increased demand for energy-hungry technology. The country's energy use is amongst the highest per capita in the world, and this figure is over seven times the international average. The huge demand for energy is fuelling environmental issues, consuming resources, and means that it is more difficult for the country to meet climate change and greenhouse gas emission targets (Asif, 2016). However, reducing demand via sustainable housing will still form part of a dual approach to energy demand by reducing the strain on the electricity transmission system.

To put this in perspective, Saudi Arabia’s energy usage has risen sharply in the past three decades. The per capita energy consumption in the kingdom approaches three times the global average, and this imbalance is still growing. Clearly, the situation must improve for the environment but also for energy consumers and for any companies building energy infrastructures. Accordingly, a policy promoting energy efficiency as part of SHP will reduce energy bills for customers and help energy providers avoid the expensive infrastructure investment needed to serve increased loads and ensure uninterrupted supply (Naif, 2012). However, while most stakeholders are aware of the benefits of energy efficiency, too few work towards implementing lower energy usage within building designs in Saudi Arabia (Taleb & Sharples, 2011). Energy efficiency is one aspect of sustainable building design that can deliver immediate savings with a relatively low upfront financial commitment.

Table 2-5: Top 15 countries in the world according to annual per capita carbon dioxide emissions adopted from Asif (2016)

Country	Annual per capita CO_2 emissions (tonnes)
Qatar	44.0
Trinidad and Tobago	35.8
Netherlands	31.0
Kuwait	30.3
Brunei	23.7
United Araba Emirates	22.6
Aruba	21.5
Bahrain	20.7
Luxemburg	20.4
Falkland Islands	19.6
Australia	18.3
United States	17.2
Saudi Arabia	16.1
Canada	15.3
Oman	15.2

- **Natural resource depletion**

At this critical juncture in human history, the world is approaching the point where natural resources, such as fossil fuels, are starting to deplete. Within a few decades, the present population will have consumed most of the available resources, leaving very little for future generations, even without taking into account the related issue of climate change (Ting, Abdul, Hakim & Wai, 2011). At present, politicians are often swayed by the economic prosperity that fossil fuels can bring to a country, and rarely think long term. Money from fossil fuel, as in Saudi Arabia, can bring wealth that a government can share among the population for an improved quality of life, access to education, and housing. Many gulf countries have moved from deserts with scattered populations into developed nations with extensive infrastructure. However, oil wealth can lead to over-dependency on a single source of investment and failing to plan for the future will see progress regress if the country does not prepare for future reduction in income from oil. Saudi Arabia's overuse of energy requires millions of barrels of oil per day, and global increased demands for fossil fuels will restrict domestic supply and start to affect world supply because Saudi Arabia is a major exporter. Saudi Arabia, in 2009, was the 13th largest energy consumer in the world, with almost two-thirds of energy produced from oil-based products (Mohammed Saied Al Surf, 2013; US Energy Information Administration, 2013). In other words, Saudi Arabia should conserve oil by lowering energy demands, while also diversifying its economy to prepare for a decline in oil wealth.

2.6.6 Legal Challenges

Legal challenges are sometimes regarded as a subset of the political factor, and they can include weak regulatory bodies and environmental law, lack of clear regulation from SEEC, unclear Saudi building codes, lack of green building codes, and lack of a national sustainability rating system. These all affect SHPs. Legal issues affecting SHPs in Saudi Arabia include:

- **Weak regulatory bodies**

Several large Saudi developers have begun looking at SHPs, mainly because they recognise that the prevailing political mood is moving towards greener construction practices (Susilawati & Al Surf, 2011). Accordingly, the government needs to increase awareness of the subject, encourage regulatory bodies to develop rules and guidelines and ensure that they are enforced (Asif, 2016). Even if developers see the need, few are willing to take on the additional financial risk if they feel that it will place them at a competitive disadvantage compared with rivals who cut corners and flout the rules.

In Saudi Arabia, as in any other country, creating unity of purpose between local and national government levels is crucial for SHP. To strengthen the political process, it becomes important to identify the most important stakeholders and understand their role in the process. As an example, a national government can make laws concerning the development of SHP, but if they are not enforced at local level, they will be ineffective. Although the country has implemented initiatives aimed at sustainable development, including King Abdullah's Green Building initiative, these need to be mandatory and enforced. In addition, developers should be informed of the way these programs can help them financially, while protecting the environment and ensuring a level playing field to prevent competitors benefiting from not obeying the rules. Otherwise, developers will not adopt the new technologies because they risk losing money. Stakeholders, as shown below, will be crucial for promoting sustainable buildings in Saudi Arabia:

- Ministry of Housing and Public Works
- Real Estate Development Fund
- National banks
- Private institutions
- Organisations housing employees
- Companies with stock funds from both the government and individuals (Assaf et al., 2010).

Importantly, REDF can support the private sector with loans where needed, and the government can influence sustainable construction by creating policies and implementing legislation that enforces sustainable building methods (Mohammed Saied Al Surf, 2013). Overall, government and regulators should enforce sustainable standards, but also open up access to financing and other benefits to encourage buy-in.

In March 2014, the government, via the Presidency of Meteorology and Environment (PME), stipulated that all construction companies had five years to comply with the new water, air and noise pollution standards. All projects had to meet national and international standards as part of a wider initiative to protect the environment, natural resources and the health of the public (Asif, 2016). This reinforces the idea that companies should take advantage of incentives before punitive measures and stricter legislation are used as tools to enforce compliance with sustainable measures.

- **Unclear regulations from Saudi Energy Efficiency Centre (SEEC)**

At a policy level, Saudi Arabia has seen some positive developments for promoting energy efficiency in the construction sector. Part of this success is due to the National Energy Efficiency Programme (NEEP), which was established in 2005 (Alyousef & Varnham, 2010). The NEEP organisation has created links and communication channels between several government departments and various supporting organisations. This has prompted a more unified approach to the promotion of energy efficiency and reliability, and the NEEP has encouraged the government to adopt policies that support the environment.

The NEEP has had some notable successes; namely, in drafting energy-efficiency codes for all new buildings in the country, creating programmes to train state employees and the public in efficiency awareness and practices, and developing energy efficiency standards for household appliances (Alrashed & Asif, 2012). However, although there has been an increase in the adoption of energy efficiency measures in Saudi Arabia, there is still room for improvement and a need to develop wider awareness of thermal building insulation, double/triple glazing, and air circulation technology for cooling.

In Saudi Arabia, one of the main problems is absence of insulation in residential buildings, with over two-thirds of buildings lacking thermal insulation. Since 2014, thermal insulation has become mandatory for all new buildings. In addition, the Saudi Electricity Company (SEC) has made thermal insulation a prerequisite for new electricity connections.

- **Unclear Saudi building code**

Saudi Arabia created the Saudi Building Code in the year 2000, when the government set up the Saudi Building Code National Committee (SBCNC) via a royal decree. The committee drew together Saudi experts from the government, the public sector, academic institutions and the private sector. To create the SBC, the committee drew upon international codes used effectively in other countries, including Europe, North America and Australia, as well as Arab building codes. The Saudi government approved the code in 2001 and released it into the public sphere in 2007. The SBC is a set of building regulations and codes that act as minimum standards for building construction, and the main purpose is to ensure the safety of public and homeowners. A body called the International Code Council was involved in drafting the initial SBC but has not been involved in any subsequent amendments. The SBC focusses on the unique society and culture of Saudi Arabia, and accounts for the prevailing climate, the available building materials, and the soils and geology of the region (SBCNC, 2007). Importantly, the SBCNC sought input from several sources, and held meetings, workshops and conferences that allowed stakeholders to share information and experiences (Mohammed Saied Al Surf, 2013). This was a first step in encouraging different sectors and institutions to cooperate, working towards a common goal.

However, few of these regulations and compulsory codes actually enshrine sustainability at the heart of the HCI in Saudi Arabia. This is despite a wealth of research and opinion suggesting that development of building standards and codes is a particularly efficient way to promote sustainability, especially for energy efficiency and water conservation (Chwieduk, 2017; Taleb & Sharples, 2011). With the SBCNC, Saudi Arabia already has experience encouraging shareholders to develop expertise, so using a similar process to promote sustainability may well be possible.

- **Lack of green building code**

One problem for Saudi Arabia is the lack of a building code in the country, and it becomes important to determine where it will seek inspiration for developing its own codes. In recent decades, governments in many countries, including Canada, the US, the UK and Australia, have gradually brought environmentalism into building codes. Numerous codes support SHPs in these countries, including LEED, BREEAM, Green Globes and Green Star, and a number of Arab nations have developed rating systems for SHPs, such as the UAE with its Estidama metrics. However, many building codes intended to promote sustainability are voluntary, and rating systems are often third party rather than working within the industry. In addition, developers are reluctant to use these codes because they believe that the additional costs are high and prevent them from competing with companies failing to adopt the voluntary codes.

Are these costs higher? It is actually quite difficult to prove that adopting sustainable techniques is financially worthwhile or even viable. Doing so involves analysing a number of costs, including design, construction, maintenance and normal operation of a building or development (Partee, 2009). Energy cost is one of the easiest measurements, because it is a relatively simple case of comparing the energy consumption of a sustainable building with a similar non-sustainable building. As an example, commercial buildings following LEED principles show lower energy costs of up to six percent when compared with similar buildings following traditional building techniques (Partee, 2009).

Accordingly, most environmental building codes rely heavily on voluntary uptake, and environmental activists and real estate developers already using such principles are lobbying for codes to become mandatory. However, uptake is still slow and, as shown by the US Green Building Council, even states that embrace sustainable codes produce green buildings with a net negative impact on the environment (Mohammed Saied Al Surf, 2013). However, any progress towards this goal and reduction of environmental impacts is desirable. Progress towards sustainability business in the HCI will take into account the fact that any move towards sustainable practice policies will be gradual.

- **Lack of a national sustainability rating system**

Despite Saudi Arabia's wealth, it has a very low proportion of certified sustainable buildings. This needs to improve. Any sustainable buildings in the country are assessed by the LEED rating system, which is not always directly compatible within the Saudi context, so a national rating system may prove to be preferable. This lack of a rating system is another of the many barriers that slows the development of sustainable buildings across the Kingdom (Mosly, 2015). Not only will a national rating system provide consistency and make enforcement of regulations easier, it could provide a basis for showing developers and homeowners that sustainable building can bring benefits.

2.6.7 Discussion of SHPs from International and Saudi Context:

The PESTEL analysis of the SHPs covers mainly two elements: global issues and local issues. Much of this analysis involves looking for overlaps between the two and highlighting areas where they differ. For example, educating homeowners on ways to change their habits to maximise benefits is common to all SHP policies, whereas cultural and social norms that affect design are often specific to particular localities.

For Saudi Arabia, this is a particularly important distinction. Saudi Arabia's SHPs are small and nowhere near maturity, making it difficult for the HCCs to build the business case for sustainability to meet global issues. For example, the small volume of housing means that, at present, the industry is a long way from contributing towards helping the country meet its carbon dioxide reduction targets.

However, to a certain extent, one important element that has emerged from the analysis is that the country can focus on local challenges first before tackling the more complex global challenges. Saudi Arabia has many nuances and country-specific issues that it can address as part of development of the industry. As the market grows and the country develops expertise, sustainable businesses in the HCI can start to contribute towards resolving problems such as climate change and create synergies between government and the private sector.

Considering the challenges one-by-one, political challenges show this division between the international and the local. Very little research in Saudi Arabia focusses on policies discussing sustainability within the context of climate change, or connections between government and private sectors. Instead, the Saudi research focusses on issues caused by subsidised electricity, the general lack of government support for the sector, and absence of support within the industry. Politics should focus on these Saudi-specific issues and encourage the industry to grow before looking to tackle international problems.

In terms of economic challenges, there is much less Saudi research on issues for the industry as a whole; again, this is because SHPs in Saudi Arabia tend to be small scale and few developers have embraced the technology. The most important challenges in the Saudi context are shaped by affordability, shortages of land, lack of incentives that encourage uptake, and the fact that developers are reluctant to commit, despite payback, because policies are not enforced and they fear that non-compliant competitors will benefit at their expense. The other major social issue is affordability, because most Saudis cannot afford real estate and home ownership is low. While affordability is an issue elsewhere, population growth in Saudi Arabia, scarcity of land, and the need for extensive homebuilding initiatives, mean that SHPs must be affordable and relatively quick to build, satisfying rising demand. In this respect, the economic challenges links to the political challenges, because enforcement of policies is the only way to overcome reluctance by creating a fair market. Policies can also free up land by preventing land banking and making land available for development.

Social challenges are possibly more important in Saudi Arabia than in many other countries due to cultural nuances and religious beliefs. Again, due to the small market, there is little awareness among stakeholders concerning the benefits of SHPs, which is less of an issue in other regions with more advanced markets and well-developed energy efficiency initiatives. Religious and cultural beliefs create a major difference between Saudi Arabia and other countries because any building design must take into account privacy, large families, and security. This means that, in Saudi Arabia, it is difficult to use design templates and technologies from elsewhere and the country must develop local design expertise alongside stronger planning legislation to ensure that houses do not overlook each other. SHPs initiatives must build houses sympathetic to Saudi sensibilities, while keeping prices relatively low.

In terms of technological challenges, for Saudi Arabia, most problems involve a lack of expertise concerning SHPs, with few professionals trained to design and construct homes. In addition, although local suppliers are present, they cannot commit to expansion until they are sure that there is a market, and they will not invest in innovation for the same reason. As Saudi Arabia invests in SHPs, these suppliers should also expand and begin to develop supply chains. Designers will begin to develop flexible housing that allows families to upgrade rather than move to a larger home. Once Saudi Arabia has expertise and local materials in place, then it can move forward towards looking at closed loop production, encouraging scalability, information sharing between sectors, and innovation. In other words, the small Saudi sector should focus on doing the simple things well and growing the market before looking at the more complex technological challenges.

For the environmental challenges, Saudi Arabia, while aware of climate change and other global issues, cannot yet use SHPs to contribute towards mitigating these issues. Instead, for a country faced with an extreme climate, water shortages and increasing energy demands, local issues will shape the environmental priorities for SHPs. In addition, in a country with huge solar capacity, large-scale renewable energy would contribute towards reducing emissions much more than SHPs; although reducing energy demand through energy efficiency would certainly reduce the need for investment in power infrastructure.

A recurring issue in Saudi Arabia is enforcement of legislation and standards. Internationally, this is less important because, in most developed countries, planners and legislators are strict, and most issues are due to lack of legislation rather than lack of enforcement. For Saudi Arabia, it is important to enhance the building codes and metrics that capture sustainability, but when the country has limited standards and poor enforcement, even for traditional construction, strengthening regulatory bodies is crucial. With enforcement in place, the country can then start developing and implementing codes that suit local needs.

Saudi Arabia's SHP is in its early stages and, while this creates issues, it leaves a blank slate that will allow the developers and the country to develop frameworks, initiatives, policies and approaches that suit its own needs and allow it to work towards better future objectives. With such practices in place, the country can start to use its SHPs to address international issues. With policies to free up land, financial incentives and plans for extensive house-building programs, Saudi Arabia has made some progress in trying to stimulate SHPs; however, the country lacks policies that encompass the entire business cycle. Some of the policies are encouraging, but they risk adoption of a piecemeal approach that tries to solve individual problems rather than developing a sustainable business that encompasses all parts of the cycle.

Encouraging greater engagement between all stakeholders, including designers, suppliers, manufacturers and government, is crucial for creating, delivering and capturing value throughout the entire process for the business of sustainability. Multiple stages, including planning, designing, manufacturing, construction, occupation, maintenance and recycling, can all deliver value, especially if tied to social and environmental benefits alongside the economic advantages. Encouraging cooperation throughout the entire supply chain, using well-defined processes, meaningful metrics and technology to promote communication, can enhance profitability and pass this onto the eventual homeowner as savings. While creating such a holistic framework for the SBMs a large undertaking requiring the right policies, legislation, technology and financial incentives, this approach could support the Saudi housing market for the foreseeable future. A framework could unlock future savings and open new business opportunities for the HCCs, helping the country fulfil its environmental and social commitments and undergo economic diversification as it moves away from an economy purely based upon petrochemicals.

2.1	**2.2**	**2.3**	**2.4**	**2.5**	**2.6**	**2.7**
Introduction	Sustainable Development Agenda	Sustainability Agenda in HCI and Best Practices	Sustainable Housing Practices – PESTEL Analysis	Sustainability Agenda in KSA HCI	KSA Sustainable Housing Practices – PESTEL Analysis	Summary

2.7 Summary

There is no doubt that meeting increasing demand for housing and perpetuating the present boom in HCI using existing, non-sustainable practices in the HCI would add significant amounts of greenhouse gases nationally and worldwide. Meeting international and national targets for reducing emissions will require a sustainable business case based on SBMS including environmental, social and economic solutions for the HCI. From the previous research, the problem facing SHPs is lack of an existing holistic framework for the SBMs, and the unique nature of the industry means that simply modifying existing BMs will not work. Accordingly, this PESTEL assessment has revealed challenges that will shape the development of the new framework in the HCI. Most challenges lie in the social, economic and technological factors. In terms of social and economic factors, lack of awareness is preventing both developers and customers from taking any action. Beside economics, the high upfront cost and lack of financing options act as market barriers to new entrants, and the long payback period further intensifies this issue. This low demand and the small market mean that SHPs are the preserve of niche builders, and that there are few resources for investment in innovation and efficiency improvements.

The small market also results in a fragmented supply chain that prevents cooperation and the development of industry standards. Technological problems are caused by inadequate training in new technologies for builders and occupiers, and the difficulty in sharing experiences across the supply chain. In addition, it is difficult to scale up lessons learned by builders and clients who have worked on small projects. To date, a significant reduction in housing's negative environmental impact has not been achieved. House owners, users and HCCs struggle to benefit economically from their existing practices, although society is ready to embrace projects to improve health, safety and provide more functional, equitable and coherent housing environments. Even benefits achieved elsewhere have not been realised in Saudi Arabia. This partly results from absence of effective SBMs that account for the barriers and obstacles unique in the context of Saudi Arabia, deterring organisations from adopting SHPs.

Overcoming these challenges is possible but only with a change to SBMs approach, which will require coordination amongst all stakeholders, including suppliers, manufacturers, government and planners. Clear guidance is required from standards and legislation, and usable metrics that can shape design and compliance, and allow customers to understand the payback period. Most of all, it will require a shift away from purely economic metrics towards a greater awareness of the environmental and social benefits. The following chapter will present the SBM approach as a resource for creating, delivering and capturing sustainable value propositions in the HCI.

CHAPTER 3

Sustainable Business Model Development: Literature Review

Sections

3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	3.10
Introduction	Review of BMs in Business and Management literature	Review of BMs in Building and Construction literature	Summary of BM and development of SBMs Definition	SBM elements in Building and Construction	SBM for the Housing Construction industry	Relationships between the concepts	Boundary/Scope of the Study	Conceptual framework	Summary

Chapter 3. Sustainable Business Model Development: Literature Review

3.1 Introduction

The business opportunities and the challenges of SHPs were discussed in the previous chapter. It is important to note that the relationship between business case and sustainability is disparate and complex to ascertain. It is observed that many HCCs have undertaken sustainability practices in housing construction but with limited success, leading to failure in exploiting the full financial potential of sustainability. Likewise, HCCs have problems in configuring abstract sustainability approaches into successful business ideas. This study suggests methods for overcoming these limitations using SBM approach.

This chapter focusses on an overview of the BM concept in varied disciplines, such as management, construction, building structures and housing construction. The chapter starts by introducing the BM and establishing relationships between BMs and business strategies. It also discusses the reporting elements of BM from the business management disciplines and construction management perspectives, drawing a conclusion from the literature relating to use of the BM in the field of housing and construction, to build a robust SBM with specific elements. This chapter specifically focusses on the highlights of using the SBM approach in the housing and construction sector. The latter part of this chapter justifies the adoption of BMs and presents a conceptualisation of new SBMs for application in the data analysis phase before summarising the findings of this chapter.

3.1	**3.2**	**3.3**	**3.4**	**3.5**	**3.6**	**3.7**	**3.8**	**3.9**	**3.10**
Introduction	Review of BMs in Business and Management literature	Review of BMs in Building and Construction literature	Summary of BM and development of SBMs Definition	SBM elements in Building and Construction	SBM for the Housing Construction industry	Relationships between the concepts	Boundary/Scope of the Study	Conceptual framework	Summary

3.2 Discovering Business Models in the field of Business and Management

The concept of the BM was developed primarily due to the advent of Information Systems (IS) and strategic analysis in the early nineties (Drucker, 1994; Magretta, 2002; Osterwalder, 2004; Porter, 1998). According to Teece (2010), BMs have existed, as per the evidence provided in his research, as early as the 1980s. The case study of ‘Swift and Company’ and re-engineering in the ‘frozen packaged meat’ industry is an example that reshaped the way businesses operated and opened the doors to new strategic thinking. In the case of Swift and Company, butchered livestock was sold to regions in close proximity to each other, due to the nature of the goods (Teece, 2010). However, this model was replaced with a new model in which a central slaughterhouse undertook large-scale meat processing, transporting the meat in refrigerated vehicles to distant places. This change not only turned the industry upside down but demonstrated the way new BMs are integral to economic advantage. In addition, BMs were found to lack theoretical underpinnings in business studies or economics. Due to the lack of clear knowledge on where to place BMs, they have existed as an overarching concept applicable to areas such as economics, marketing, and organisational and strategic management. New organisational forms have emerged out of necessity, such as smart thinking and good use of technological advancements. According to Teece (2010), because of the inherent nature of BMs, they will continue to exist as a multidisciplinary subject.

The BM concept received significant attention during the era of the internet, the development of desktops, PDAs and mobile phones. Since then the idea, promulgated by the Business Modelling concept, has been debated by investors and scholars (Osterwalder & Pigneur, 2005; Zott et al., 2011). BM emergence has found significant affinity with the emergence and expansion of e-business (Timmers, 1998; Zott et al., 2011). It is fair to say that because of e-business, BMs have become more important to strategic management studies (Sommer, 2012). According to Linder & Cantrell (2013), despite the close relationship between e-business and BMs, their existence is not confined to dot.com growth. As per Bukhart et al. (2012), BMs have a unique place in information studies and strategic management. Similarly, Lambert & Davidson (2013) have argued that BMs, because of their relevance to the application area, are an individual topic in management research. In recent research, BMs are viewed as a topic best suited to independent research and in relation to value creation in order to guide companies to become productive and sustainable (Osterwalder, 2004; Teece, 2010). Wirtz (2010) suggests that BMs are applicable in various industries, such as Business Units (BUs), industrial corporations and product assembly lines. Zott et al. (2011) studied the growth of the term BM and found that, from the beginning of the 1990s, the number of articles about BMs, including academic works and scientific papers published in peer-reviewed journals, increased. Moreover, Massa et al. (2016) conducted a similar longitudinal investigation of the number of journals published on the same topic, revealing that such a trend continued throughout 2015 and beyond (see figure 3-1).

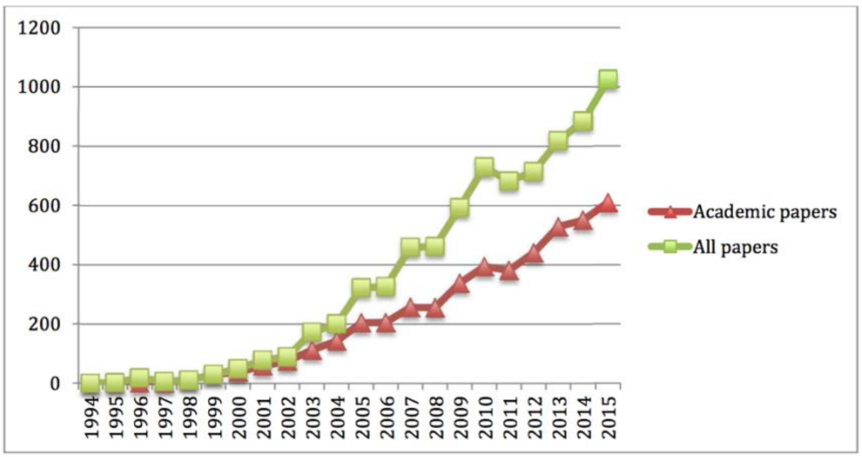

Fig 3-1: Growth in Business Model Research (number of articles published per year) developed by Massa et al., (2016).

While there have been many proponents of the BM, there is an equally disparate view, criticising it for its ambiguity and lack of grounded theory (Hedman & Kalling, 2003). According to Michael Porter (1998), the BM driven approach in managing a business is an invitation for faulty thinking and delusion, deficient in sound management principles. Some authors blame this ambiguity on insufficient understanding of the BM concept, or associate it with other concepts, such as Business Strategy (Casadesus-Masanell & Ricart, 2010; Osterwalder, 2004; Zott et al., 2011). Therefore, to utilise the concept of the BM and its association with strategy, it is crucial to reduce the ambiguity around this concept. The following sections are an attempt to remedy this situation.

3.2.1 Differentiating Business Model and Business Strategy

The core philosophies of Business Strategy (BS) and the theoretical foundations are similar to the BM concept. However, Sommer (2012) argues that BS should be differentiated from BM development. BS development is targeted at the future success and viability of business in a dynamic and competitive environment (Porter, 2008). Furthermore, the BM transforms business strategy by developing a logical framework that helps create economic value (Osterwalder, 2004). According to Teece (2010), the BM is an umbrella term without a specific direction, whereas BS is more explicit and specific. Thus, it is essential to combine BM with BS to sustain the competitive advantage resulting from business management and design principles. It is fair to state that, as per the literature, BMs and BS have considerable interlinking that cannot be side-lined.

According to Zott et al. (2011), two main factors distinguish BMs from strategy. First, BS has a competitive dimension to sustain competitive advantage, whereas BMs are concerned with creating value, cooperating and partnering. In essence, BS is oriented towards capturing value, and BMs are aligned with value creation and capture. Secondly, BMs place critical emphasis on value propositions and the role of the customer in defining business value. According to Seddon & Lewis (2003), BMs are focussed on the underlying logic that allows firms to generate value for stakeholders and customers, while keeping a strategic outlook within their purview. Therefore, a BM is an intellectual demonstration of part of an organisation's strategy, outlining the necessary information needed by firms to successfully deliver value. According to Sommer (2012), BS represents a plan that predicts business success and viability in competitive and dynamically changing market conditions, whereas BMs are the core blueprints of a business, performed by organisational structures, processes and systems, leading to the creation and capture of economic value. This view is similar to the understanding promulgated by Casadesus-Masanell & Ricart (2010), who discuss BMs in terms of the realised strategy of firms. Thus, the BM becomes an important topic while translating BS into business processes. In fact, BMs act as mediators of the BS and operational conditioning of a firm.

To ascertain the company's level of competitiveness, it is crucial to consider three aspects: BS, BM and the Operational Layer of Business (Sommer, 2012). This relationship can be understood from the picture shown in figure (3-2)**.**

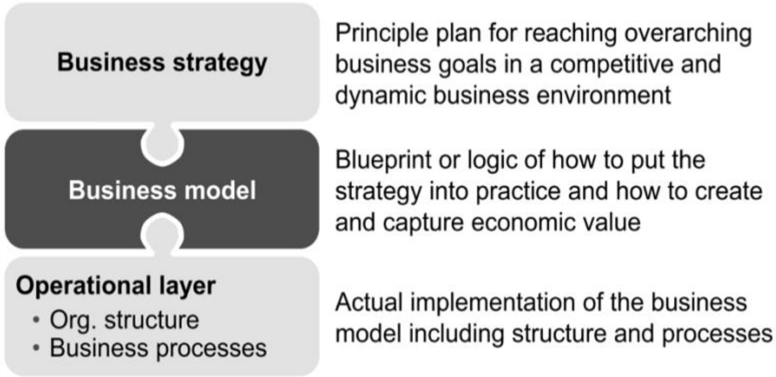

Fig 3-2: Relationship between business strategy, business model, and the operational layer adopted from Sommer (2012)

Casadesus-Masanell & Ricart (2010) have shown an integrated framework that distinguishes and relates the three concepts. The framework is divided into two parts. The first part deals with strategy, where firms select a BM that can be used to compete in new markets and the BM remains within the firm's business and operational logic and value creation methods for its customers. The second part is the tactical stage, where critical steps are taken from the available possible solutions, based on the selection of BMs in part one. This part resembles the operational model discussed earlier, but inclining more to conscious decision-making (Sommer, 2012). According to Casadesus-Masanell & Ricart (2010), it is imperative for a manager to find a way to separate strategy, BMs and tactics and to understand how they interact in order to compete in the marketplace. In summary, scholars have argued the immense potential of the BM and the necessity for a clear definition without isolating it from strategy (Sommer, 2012; Teece, 2010). Further elaborated definitions and elements of the BM are given below.

3.2.2 Defining the Business Model and its Key Elements

This section presents definitions and key elements from BM literature. This information will be used to remove ambiguity and establish key elements that lead to the development of a common terminology. As mentioned earlier, the BM technique is widely adopted in the e-business paradigm. However, it is crucial to understand the BM as defined in e-business literature. There are two core views in e-business literature: first is defining and describing the components that form an e-BM, and second is considering the e-BM in detail. Both views complement each other to some extent (Hedman & Kalling, 2003). According to Timmer (1998), an e-business model is a framework for products, services and flow of information, along with a description of unique business activities and their roles. Similarly, Amit and Zott (2011) argue that the three e-business model components for creating and delivering value are achieved with utilisation of any existing business opportunities. The components are content, structure, and management of transactions. Gunatilake & Liyanage (2010) have developed components that exhibit value for customers, scope, activities, implementations, cost, revenue source and sustainability. These components are applicable to both conventional BMs and e-BMs (Hedman & Kalling, 2003). The second line of understanding on e-business examines specific BMs and explains how businesses can improve customer and stakeholder communication over the internet as well as value creation. According to Weill & Vitale (2001), there are primarily eight e-business models, as found from a systematic analysis of several case studies. These BMs are further investigated to identify the process used for earning revenue, the core competencies that help them achieve those objectives and the critical factors that must continue to be considered.

A detailed review of literature on BMs was conducted by Zott et al. (2011). The process involved searching for articles and published media for critically evaluated research papers on BMs in management literature published from 1975 to 2009. The study found significant disagreement among scholars on what constitutes a BM, which has led to BM literature development in silos. Another finding of the study was the deficient nature of BMs in practitioner-oriented research work databases, like the Harvard Business Review and the California Management Review. Despite obvious shortcomings, Zott et al. (2011) presented four common emerging themes in BM literature. These are presented below:

- The BM is an emerging concept and framework for assessing businesses
- BMs are system-level and overarching in understanding and defining how a business operates
- Conceptualising the BM is dependent on current organisational activities
- The goal of a BM is to demonstrate how value creation and value capturing occurs in any given business

While these four themes have demonstrated the significant use of BM concepts in understanding the behaviour of a business or a company, Nenonen & Storbacka (2009) have presented another list of literature with conceptualisation of BMs based on five similarities. These are given below:

1. The BM explains value creation methods adopted by firms for its customers
2. The BM shows how a firm's operation is responsible for its revenue generation
3. This activity clarifies the relationship of the firm with internal or external players in the value chain network
4. The BM depicts resourcefulness and capabilities that exist in the firm's foundation
5. It identifies the major strategic decisions taken by a business

As mentioned earlier, the BM has evolved as a new concept without clear unification on boundaries on which scholars agree. Despite lacking coordination, BMs in all discussed definitions have included value creation and capture for customers. Therefore, it is safe to assume the duality of value creation and capture (Afuah, 2004; Osterwalder & Pigneur, 2002; Zott et al., 2011). Slywotzky (1996) has contributed to this belief by defining the BM as the entirety of customer selection, differentiation; and by defining the offerings of a company. It also goes on to define the BM elements in terms of tasks delivered and tasks outsourced, the way business channels will extract resources and select markets, method of value creation for customers and value capture. Therefore, the entire business ecosystem revolves around creating, capturing and delivering value and earning revenue from those activities. The above corresponds with Osterwalder's (2004) view on BMs studied in past literature. According to Osterwalder, the BM is a conceptual tool having element sets and their relationships with which a company expresses money-earning logic. It exhibits the value offering to its customers and the framework of the firm with which it aligns to serve those needs. BMs expose the way businesses and business partners create, market and deliver value to create sustainable and profit-making revenue channels. Osterwalder (2004) has developed nine BM elements organised into four pillars. These are shown in table (3-1) below:

Table 3-1: BM Elements developed by Osterwalder, (2004).

Pillar	BM Building Blocks/Elements	Description
Product-Offer	Value Proposition	Provides high-level knowledge of all products and services that could be of value to a user
Customer Interface	Target Customer	A group of people to whom the firm hopes to deliver value
	Distribution Channel	How to get in touch with prospective users
	Relationships	Defining the established links between a business and its customers
Infrastructure Management	Value Configuration	How activities are arranged, and resources required to create value for customers
	Key Resources	The quality of repetitive execution of actions necessary for value generation for customers
	Partner Network	An agreement with two or more companies (external) for creating customer value
Financial Management	Cost Structure	The representation of capital in all the means used in the BM
	Revenue Model	Shows how the business makes earnings with a variety of revenue flows

The pillars shown above describe what tangible or intangible benefits are given to customers. A customer is defined using the customer interface pillar and the way value offerings are generated. Infrastructure management is aimed at customer value creation for target customer groups and the way a firm creates value through internal and external capabilities and partner networks. The financial aspect creates an outline of how the business plans to make money through its adoption. According to Osterwalder & Pigneur (2010), businesses can adopt a BM to understand their value creation processes through visual tools such as the BM canvas. This tool has been internationally acknowledged as a practical tool for analysing the BMs of many businesses see figure (3-3).

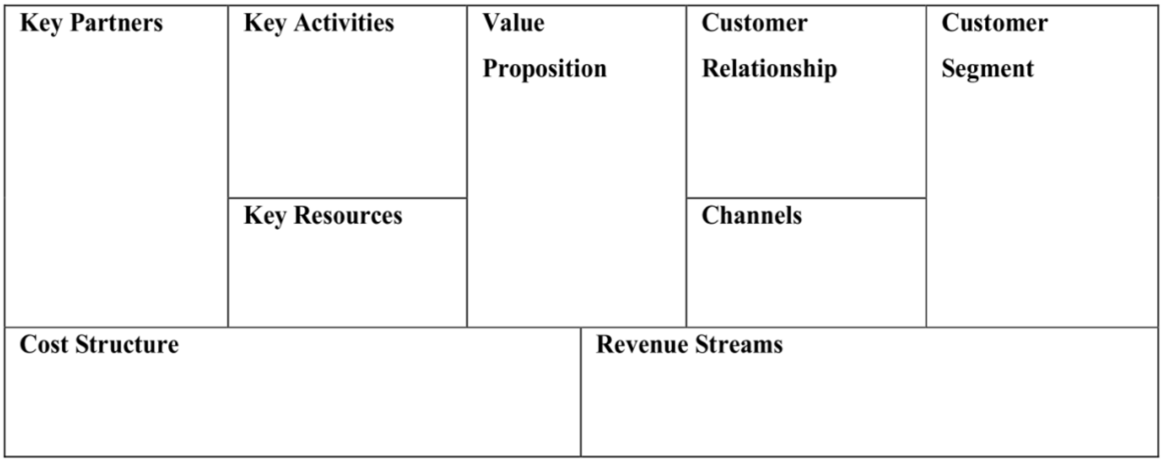

Fig 3-3: BM Canvas developed by Osterwalder & Pigneur (2010)

As shown, the BM canvas provides a view of the organisation's pillars of value creation and capture. It helps to systematically challenge how business is done and the things that a company can do differently to develop new business models. According to Johnson et al. (2008), further details are proposed for the BM concept, consisting of four interlocking elements that support in tandem to create and deliver value. The authors' view is significant due to the ability of those elements to transform their BMs. These four elements are:

1. Customer Value Proposition (CVP) – shows how to create value for people. It is the foremost BM element.
2. Profit Formula (KF) – tools to explain how a firm creates and captures value for itself and its customers.
3. Key Resources (KR) – mainly assets comprising people, innovative technologies and facilities needed to provide value for customer segments. The focus is on key resources to create differentiation.
4. Key Processes (KP) – are managerial and operational processes that allow a company to deliver value effectively.

These four elements are presented in greater detail below figure (3-4):

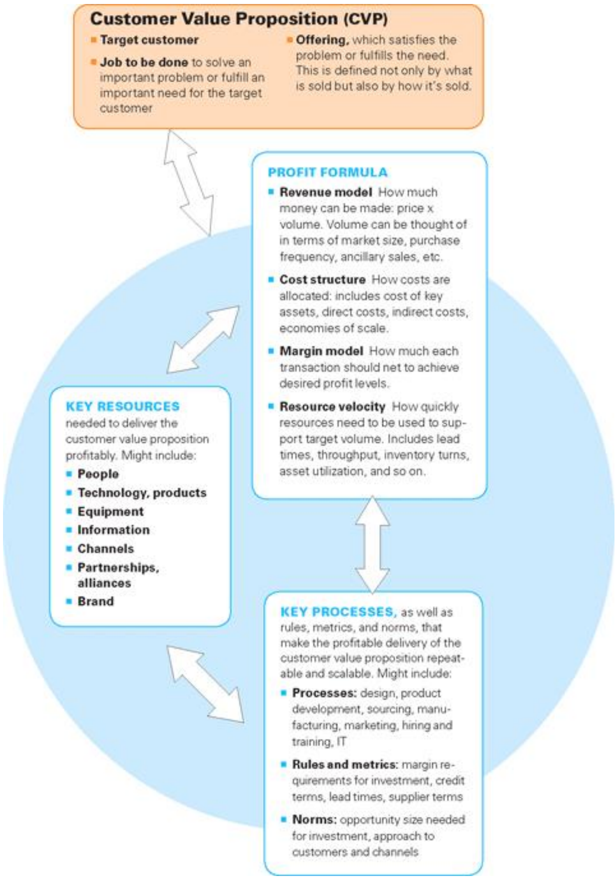

Fig 3-4: Elements of BM adapted from Johnson & Christensen (2008)

This figure shows the elements of a business model with its comprising sub-elements and explanations. A business model, therefore, develops into the rationale of how an organisation creates, delivers and captures value. It is clearly a simple working formula reflecting the fundamental learning of BMs constituted into a single definition. This definition will be used for the purpose of this study.

3.2.3 Applications of a Business Model in Different Fields

This section provides examples from the literature on BMs and shows how this concept is applied to demonstrate its effectiveness. The examples given below are not comprehensive but illustrative of the concept.

- **Source of Competitive Advantage**

Ormanidhi & Stringa (2008) define competitive advantage as a lead held by a firm over its competitors that allows a company to remain profitable while retaining its customers for a longer period that its competitors. The primary objective of almost every business strategy is to create sustainable competitive advantage (O'Farrell, Kitchens & Moffat, 1993; Porter, 1998).

A company that can create and sustain this value by allowing the business to do things differently from its competitors will be successful. For any profit-oriented company, business viability rests on how value is created and captured (Aki Pekuri, Pekuri & Haapasalo, 2013). Shafer et al. (2005) argue that a company's success rests on two primary functions: value creation and capture. Research papers provide examples of how business models are essential for several successful companies (Teece, 2010). According to Magretta (2002), the BM should be hard to copy, and when it alters the financial logic of an entire industry, then that BM has achieved competitive advantage. Agreeing with the view of Magretta (2002) are Al-Debei & Avinson (2010), who argue that e-businesses may have the ability to extend their competitive advantage by choosing a matching BM and improving the ability to address changes in their environment. In addition, several scholars have highlighted the need to innovate BMs to sustain market advantage. Johnson et al. (2008) argue that innovation in BMs is more significant for business success than innovation in the product or service itself. According to Hamel (2000), cited in Pekuri et al. (2013), innovation in BM innovation may be the most proficient method for outperforming a competitor. Therefore, the literature presents multiple examples of innovation in BMs and their relationship with business success (Boons & Lüdeke-Freund, 2013). Several scholars (Mitchell & Coles, 2003; Morris, Schindehutte & Allen, 2005; Teece, 2010) argue that BMs have been differentiated to a sufficient extent to meet the expectations of a particular customer segment and are increasingly difficult to replicate, which can be a source of competitive advantage.

Innovation on BMs and its transformation is challenging because only a few managers can understand the company and its BM and critically understand value creation and capture (Johnson & Christensen, 2008). If managers can be provided with a detailed analysis of business models using a predefined set of elements, it would help them in understanding the value proposition and value delivery with clarity. Likewise, Pekuri et al. (2013) say that managers can use key elements as tools to acknowledge, design and review BMs. This would also help review existing interdependencies among the BM elements. Therefore, the BM concept exists also as a tool for organisational management and is applicable to almost every type of company to help create competitive advantage.

- **Information Systems (IS) and BMs**

Existing BMs have the characteristics for defining the concept in the context of the study. Whether establishing elements or suggesting practical approaches to leverage BMs, they are defined within the limits of the context. The study by Al-Debei & Avinson (2010), in which a framework of a BM for information systems is developed, is derived from a comprehensive review of information systems, e-commerce and e-business, BM literature and technological studies. In creating this framework, Al-Debei & Avinson (2010) have presented the BM construct and listed its four dimensions along with its corresponding elements. The model is placed in the digital business context and the functions of BMs are explored further in the scope of digital organisations. This approach is not only comprehensive but novel in the sense that it can be considered a relevant application of BMs.

In the last decade, businesses have experienced major transformations; from the contemporary ways of conducting business, to adopting digital pathways primarily in the e-business domain. This transition is governed by highly competing forces, a dynamically changing environment, risk, and information creation and innovation. Therefore, traditional methods of doing business are losing out due to market forces – businesses that have adopted the digital model and created their footprint early. Traditional business methods revolve around strategically aligned business goals, reflected through operations. However, application of these methods in new generation digital businesses highlights a gap requiring further attention. Scholars argue that BMs can potentially create this bridge between traditional and digital business evolution.

A set of dimensions that form the basis of designing and analysing BMs related to the information systems domain is given below (Al-Debei & Avinson, 2010) . The dimensions given see figure (3.5) portray the most important components of a BM:

- Dimension 1 – Value Proposition is the main product or service offering, along with its related information from a digital organisation
- Dimension 2 – Value Architecture is the combination of assets, both tangible and intangible, the core competencies, infrastructure and configuration of a digital organisation, which includes the technology
- Dimension 3 – Value Network is a representation of the inter-organisational and external relationships that support value generation achieved by collaborating and coordinating entities
- Dimension 4 – Value Finance is a depiction of the information related to financial and economic parameters of BMs, which includes areas such as costing, pricing and revenue generation.

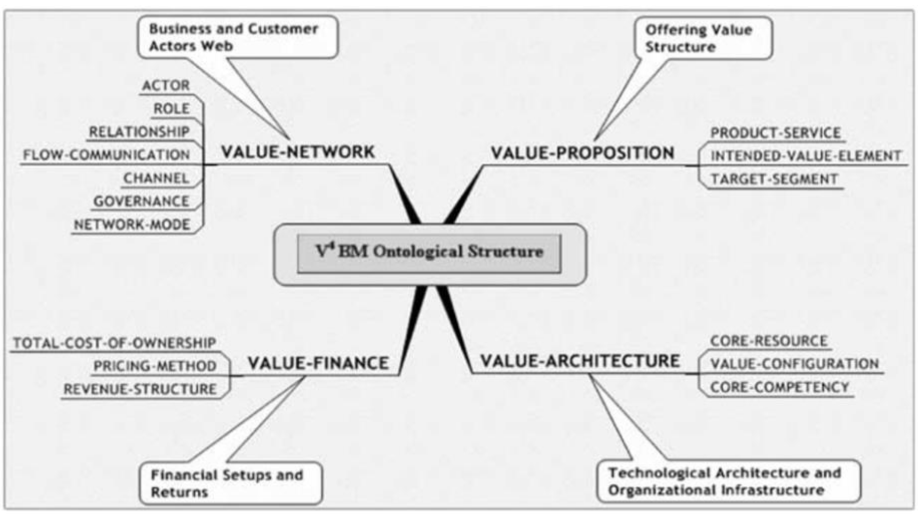

Fig 3-5: The V4 Ontological Structure of BM adopted from Al-Debei & Aviso (2010)

These four dimensions of a BM pertaining to the IS domain highlight the interdependent relationships between those dimensions. This is a fundamental view for decoding BM thinking because a BM is a step-by-step tool used for presenting the business logic. The authors identify three main roles of BMs in the digital business context. First, the BM plays a role in aligning inter-organisational layers, such as business strategy, BM, business processes and IS. However, these layers should not be viewed in isolation but as a compact bundle requiring periodic review and should be adapted to the external environment and stakeholder interests. Second, the necessity of the business model as a connecting tool between technological innovation and business strategy is visible. A business model should be viewed as the prime reason for success or failure of a technology. Therefore, digital innovation value capture is feasible by applying the BM concept. The BM can be viewed as knowledge capital that increases both the potential for innovation in a business and its decision-making abilities, which ultimately contribute to the organisation's ability to create sustainable competitive advantage see figure (3.6).

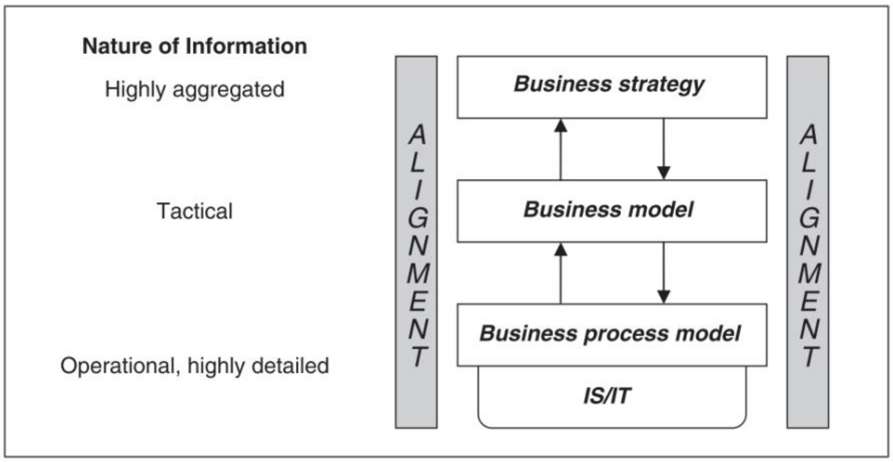

Fig 3-6: Digital Business layers adopted from Al-Debei & Avison (2010)

- **Business Model and Project Based Businesses**

This section demonstrates how the BM concept is applied in project-oriented business and highlights the applicability of the concept across multiple disciplines. Researchers have used the BM concept in understanding business logic in projects undertaken by firms. This was possible for two reasons. First, project-oriented companies have found their way into several industries, such as construction, professional services and sports. Second, adding services to project businesses has led to their exit from markets or forced them to compete by finding new methods of performing business. Wikström (2010) has used multiple case studies to evaluate six project-driven firms with business operations in areas such as energy, telecommunications, construction and shipping. The study aimed to identify BMs applicable to each of the six companies and concluded with 19 BMs that were clustered into three categories, depending on the organisational entities. These categories are discussed below:

- Single Project Business Model – this model targets individual projects. The aim is to provide delivery of technical expertise and equipment. The single project BM focusses on the internal subjects of projects without considering the external parameters or involvement of the clients. Individual projects can have multiple players; thus each business model needs sufficient flexibility to be able to merge with the BMs of supporting businesses to achieve successful project delivery. The value proposition of a single project BM is limited to a set of products and services in areas like logistics, servicing and manufacturing provision during operations.
- Project Networks and BMs – this category provides integration of activities conducted by external companies, thereby improving engineering and organisational network competence. The core focus here is on the client's strategic benefits. Thus, the model needs in-depth analysis of client needs and the ability to provide flexible offerings in a diverse integration setting. Project networks are characterised by a complex and demanding organisational setup, as project suppliers are linked to clients and all stakeholders. Project network BMs extend beyond the boundaries of a single company and integrate with network partners.
- Business Network BMs – every BM in this grouping involves a considerably-sized network of actors that interact with other associated stakeholders and BMs. The model creates value for multiple actors, such as clients, contractors and subcontractors. The aim is to target profitable growth for the involved actors. Challenges encountered in this domain include the need to create alliances among new actors who are willing to trust each other and devote their resources to a common project that enables them to connect technologically, economically and socially. BMs are driven to seek benefits in the long-term by creating sustainable relationships with clients and offering complete solutions. Therefore, project-based companies have a business model similar to that of competitors, while operating in the same business network or industry.

	Category I 6 business models of 19	Category II 9/19	Category III 4/19
Value proposition	Manufacturing, logistics, installation support	Design and system integration, various service concepts, solutions including operational support	Investment advice, solution, support and life-cycle support
Investment effects	Impact on functionality and operational expenditure	Impact on functionality and OPEX, earning potential, strategic	Strategic and income related
Flexibility	Modular products	Modular products, network of engineers, customer-oriented, integrated solutions	Customer-oriented integrated solutions
Organizational entity	Individual projects	Egocentric networks	Developing and implementing business networks
Organisational arrangement	Coordination and manufacturing	Coordination, integration, network, processual, geographical, competence centres, manufacturing including services	Integration and network
Nature of innovation	Product improvement, incremental	New business solutions and systems, service innovation and development	Business concepts
Growth mechanisms	Economies of scale	Size of scope and scale, amount of assignments, differentiation in offering	Size of scope
Distinctive competence	Availability and reliability, environmental issues, efficiency, flexibility	Understanding the customers investment need and how to make it competitive,	Developing business
Core competence	Technology, environmental	Integration, centralisation and geographical distribution, knowledge base, technology	Customer business knowledge, engineering knowledge, life-cycle services, technologies
Critical assets	Manufacturing capability	Engineering competences, competence base, trust delivery system	Trust delivery system, industrial logic knowledge
Customer involvement	Low and predictable	Provides start-up data, supports development, continuous interaction and co-creation	Co-creation
Relationships	Large amount, disruptive operators, investors, sub-suppliers, authorities	Small, medium and large amount, both disruptive and continuous	Small amount, continuous, integrated
Relational context	Processual integrated to firm	Investment/customer focus, continuous	Investment/customer focus
Collaboration mechanisms	Standard, mechanistic, partnerships	Iterative, improvisation, innovative, both operational and strategic partnerships,	Iterative, improvisation, innovative, partnerships

Table 3-2: 19 business models categorised according to organisational entity adopted from Wikström et al., (2010)

The findings from these categories of BM suggest that companies can function with more than one BM. However, research primarily aims to review the concept from an organisation-wide view and apply it to the current research.

- **Business Model for Sustainability and Sustainable Business Model**

The global population is extremely likely to increase in the near future, which would accelerate global development. The associated consequences of a growing global population and development would be increased utilisation of scarce resources as well as increased environmental waste. In simple words, doing business in a conventional way is not a choice for our generation. Human activity is responsible for using the equivalent of 1.5 earths (WWF, 2002). This confirms that the rate of resource consumption is unsustainable (Randers, 2012). There has always been a need for awareness of the value of ecological systems and natural capital to back human welfare (Constanza et al., 1997). Environmental and societal consequences are not prioritised in traditional BMs that have been in use for decades.

Academics and practitioners have an interest in researching SBMs. Examples can be seen in the *Journal of Cleaner Production* (vol. 45, April 2013) and *Organisation and the Environment* (vol. 29, March 2016). The researchers provided comprehensive overviews of the topic and suggested that there is a growing interest in this approach, and future development of the SBM is needed (Bocken, Short, Rana & Evans, 2014; Boons & Lüdeke-Freund, 2013; Evans et al., 2016; Massa et al., 2016; Schaltegger, Hansen & Lüdeke-Freund, 2016). Following on from this work, the industry has made some progress during the last decade. Companies are adopting BMs that assist in becoming sustainable to attain company goals and support development of economic systems.

Factors like internationalisation and need for SDGs have combined to make business competition even more intense and complex. Hence, BMs should provide appropriate solutions for surviving business competition. The idea is that SBMs promote empowerment of conventional BMs to support a firm to attain competitive advantage while improving productivity and profitability (Schaltegger et al., 2016a). Consequently, the idea generates value for the Triple Bottom Line (TBL), which supports sustainability in economic, social and environmental areas (Dyllick & Hockerts, 2017). Incorporation of sustainability principles with sustainable goals and value proposition can be contained in SBMs (Boons & Lüdeke-Freund, 2013). Other essential areas that are supported by SBMs include value creation capability and value capture functions.

With a focus on sustainability, SBMs are set to involve proactive management of multiple-stakeholders and innovation to achieve long-term goals. Hence, SBMs can decrease the harmful effects of business activities on the environment as well as on society. In other words SBMs can assist firms in attaining economic and sustainability goals (Holliday, Schmidheiny & Routledge, 2017). Therefore, SBMs have evolved as a platform on which business activities can be integrated with sustainability. Furthermore, Circular Business Models (CBMs), while reflecting elements of SBMs, have additional characteristics that control the speed, intensity and range of resource loops (Geissdoerfer, Vladimirova & Evans, 2018). Additionally, Geissdoerfer et al. (2018) assert that researchers in SBMs incorporated sustainability in two main approaches; a) embodying ideas, principles, or the core element of sustainability; b) incorporating sustainability into their value proposition, value creation, capture mechanisms and delivery activities.

According to Evan et al. (2016), businesses have become capable of achieving sustainability with the help of SBMs. Studies by Boons et al. (2013), Geissdoerfer et al. (2018), and Schaltegger et al. (2016a) also offer related definitions and concepts for SBMs. Lüdeke-Freund (2010) argues that industrial systems can use the SBM approach as a tool to attain social and environmental sustainability, and Brocken et al. (2014) state that although the process of attaining a SBM has limitations and challenges with regard to clarity, the transformation of BMs to sustainability is immensely effective. In spite of the existing body of knowledge on the theme of SBMs, a comprehensive plan for implementation of sustainability that is helpful to companies in different industries is not available. A research gap exists specifically between the execution and the development process in the SBMs. Therefore, it is necessary to identify the applicability as well as the benefits of SBMs to facilitate future growth in different business domains.

In consideration of the overall background of the emergence of BM approaches in a business management context, the following section provides an overview of the development of BM thinking in the building and construction discipline.

3.1	**3.2**	**3.3**	**3.4**	**3.5**	**3.6**	**3.7**	**3.8**	**3.9**	**3.10**
Introduction	Review of BMs in Business and Management literature	Review of BMs in Building and Construction literature	Summary of BM and development of SBMs Definition	SBM elements in Building and Construction	SBM for the Housing Construction industry	Relationships between the concepts	Boundary/Scope of the Study	Conceptual framework	Summary

3.3 Review of BMs in Building and Construction literature

A systematic review of BM research in the construction discipline from Jan 1990 to 2014 can be found in Pan & Goodier (2011), Zhao et al. (2016) and Abuzeinab (2015). Business model development has witnessed significant developments in the past five years. This is based on the following assumptions:

Firstly, according to Aho (2013) and Pan & Goodier (2011), there were limited examples of well-developed studies encompassing BMs in the construction discipline from the 1970s to 2011. Pan & Goodier (2011) have explicitly stated that a large sample of BM literature lies in business and management contexts, and BMs in the construction industry are extremely underdeveloped. The majority of cited articles reviewed in Pan & Goodier (2011), such as Seaden et al. (2003), Green et al. (2008), and Li et al. (2009) has implicitly applied BM in the construction discipline while citing BMs from business and management literature. Thus, the theoretical and conceptual development of BMs was deeply rooted in business and management. However, new studies have explored the BM development, using IT technologies, by foraying into e-commerce as a saviour for BM development. Secondly, the BM construct has been widely used in the last decade due to its potential for providing a holistic view of companies and business activities (Brege, Stehn & Nord, 2014; Wei Pan & Goodier, 2012; A Pekuri, Pekuri & Haapasalo, 2013).

A review of articles that have emerged in the construction disciplines in the last ten years has provided a closer view of the progress in construction-related BM literature. For example, Moschetti et al. (2018), Abuzeinab (2015), Aho (2013), Pekuri et al. (2013), and Mokhlesian & Holmen (2012) have provided an explicit definition of a business model before applying the theory to the construction sector. In their respective publications, scholars such as Wasiluk (2013) and Sweetser (2012) have given limited overview and understanding of BMs when addressing issues such as organisational change to sustainable BMs and performance-based BMs. The following table (3-2) shows the articles reviewed since 2000 on BMs in the construction discipline, supporting the gap for this study.

Table 3-3: BM Articles in the Building and Construction industry reviewed between 2000 and 2018

Author/ Year	BM definition	BM elements	Contribution of the Study	Gap
Iacovidou, Purnell & Lim (2018)	A circular BM focussing on the use of Radio Frequency Identification (RFID) technology for increasing new and secondary material reuse in a way that benefits and supports the growth of recycling industry in the construction sector.	The article is salient on the business model elements	The paper explores the potential pre-conditions for RFID to facilitate construction components reuse.	Focus is on the creation of BMs that bring sustainability thinking from the efficient use of materials stored, tracked and managed using RFID tagging. However, efficient use of materials is in some parts of the SBM but not all.
Zhao et al. (2017)	The fundamentals of the BM concept lies in the design, content, structure and way transactions are governed, leading to value through the careful selection and targeting of opportunities (Zott et al., 2011).	Financial model, Costs, Corporate strategic benefits, Risks, Firm reputation, Competitive advantage, Environmental performance, Social performance	To develop a model using AHP-ANP Fuzzy network for evaluating the performance of BMs for sustainable building.	Emphasis on BM innovation for increasing the uptake of sustainable building. The AHP-ANP decision making approaches facilitate resolution of complex problems for the benefits of SBs without reviewing each element of the BM in depth and how the new BM will fit together. Focus on transition of BMs into innovative ones.
Abuzeinab, Arif, Kulonda & Awuzie (2016) & Abuzeinab (2015)	This research relies on Sommer's (2012) definition for the green business model in which he conducted seven case studies. He discusses GBMs from theoretical and empirical perspectives. GBM is ‘a business model that represents a significant improvement (discontinuous leap) in overall environmental performance relating to its entire value chain system vis-à-vis that of conventional business models.	Green value proposition, Target group, Key activities, Key resources, and Financial logic	The purpose of this paper is to investigate the transformation of green/ environmental business models.	The paper suggests environmental sustainability as the value for economic success by improving the economic positions of the value chain within the construction sector. However, it seems that it would be hard for the organisation to implement the environmental aspect without looking to the social requirements. This paper will cover both aspects.

Author/ Year	BM definition	BM elements	Contribution of the Study	Gap
Zhao et al. (2016)	Business model is 'the logic of how interrelated decision variables in the areas of business strategy, value creation and delivery, and economics are addressed to create corporate competitive advantage.' (Zhao et al., 2016)	Product/service Value proposition Target customer Organisation and activities Role in value network Resource and core competency Competitive advantage Cost and revenue model	The paper argues that few have explored the role of BM in the delivery of ZCBs, which may explain the slow uptake of the ZCB approach.	The paper examines the effect of BM on ZCB research and explores how business model innovation can help to deliver ZCBs. Nevertheless, it is worth noting that business models for ZCB vary with external political, social and environmental conditions, which the paper doesn't investigate. The paper will be covering more than zero carbon building challenges and considering more environmental and social aspects.
Brege et al. (2014)	No clear definition of BM	The business model includes: Offering: Value Proposition Customer Segments Market Position: Value network Operational Platform: Resources Competences	The 'aim is to adapt a general business model construct and use it to empirically identify the most frequently used and the most viable business model' of industrialised multi-storey building	The paper rests on the BM approach to ease industrialised building uptake of housing delivery. Although the paper has generated insights on the elements of the BM, it has not presented the BM. Also, it does not mention the sustainable value of the adopted BM.
Pekuri et al. (2013)	No clear definition of BM	Using the 'most frequently quoted review of business model papers lists nine elements that offer a scheme for characterising business models (Osterwalder et al., 2005).'	'The purpose of this research is to explore how managers understand and deploy the business model concept in construction.'	This paper highlights the way contractor directors from construction firms understand the BM theory. Suggestion that the BM can be beneficial for measuring how they provide value for clients. This paper covers a general value creation. However, this study will focus on sustainable value proposition creation and capture, covering the BMs through the whole industry.
Aho (2013)	BM outlines 'the architecture, principles, logic and capabilities that an enterprise applies for creating, delivering and capturing value.'	No clear BM elements	'Research into sustainability of buildings should be underpinned by innovation in BMs that: (1) provide business incentives for long-term service levels and performance of actual facilities; (2) enable and empower professionals	The study builds the case for performance-based BMs and sets situations for BMs to empower changes in the construction industry in ways that implement sustainability. Although the paper presented plain definition for BMs, it did not

Author/ Year	BM definition	BM elements	Contribution of the Study	Gap
			within the businesses to act according to long-term goals; and (3) provide sufficient short-term returns for financing the two other objectives.'	define what creates the BM, which is crucial in the transformation process. This gap in knowledge will be presented in the current study.
Mutka & Aaltonen (2013)	A BM conceptualises the ways in which a firm creates and captures value. It comprises the strategic choices, the organisational architecture and the economics of the firm.	'Resources and capabilities, Internal organisation and activities, Revenue creation logic, Customer, Value proposition, Partner network and Competitive strategy.'	The paper presents the gap in the literature on 'understanding of the role of project-level business models in a PBF.'	The paper presents the BM elements needed for PBF and a definition of the BM for project-based firms. However, the paper doesn't handle sustainability as the goal of the projects and the necessary BM elements when doing sustainable projects. This research will also present the changes required in the BM when building sustainable value.
Wasiluk (2013)	No clear definition of BM	No clear BM elements	The 'aim of this paper is to draw a conceptual bridge between the intellectual capital (IC) and corporate sustainability (CS) literature to investigate how firms mobilise their IC in order to implement sustainable development into their business practices.'	The paper supports IC to push organisational transformation to sustainable BM. However, the study doesn't include what is BM and what differentiates normal and sustainable BMs. This research will address these matters.
Mokhlesian & Holmén (2012)	No clear definition of BM	The most frequently quoted review of business model papers lists nine elements that offer a scheme for characterising business models (Osterwalder et al., 2005).	The purpose of the paper is to review recent green construction publications in order to investigate what elements of the business model a construction-related company undertakes for green construction.	This paper analyses and builds BM for green construction by adopting BM canvas from Osterwalder et al. (2005). It is based on secondary data unlike the current study that covers both theoretical and empirical data. It recommends that the BM elements are linked. This current research goes a step further and validates the interrelation through empirical findings.
Wei Pan & Goodier (2012)	BMs 'have long been necessary features of market economies that include: 1- consumer choice, 2- transaction costs, 3- heterogeneity among consumers and producers, 4- competition (Teece, 2010).'	No clear BM elements	The 'paper presents the interactions between the BMs in U.K. house building and the different types of off-site technologies, from which a conceptual model is thus developed.'	This paper depends on secondary data with less than 10 references applying the BM concept to the building. However, it implements the BM approach to help OSC uptake of housing construction. Although the paper generates insights about BMs, it doesn't show the elements of the BM.

Author/ Year	BM definition	BM elements	Contribution of the Study	Gap
Sweetser (2012)	No clear definition of BM	No clear BM elements	The paper presents a BM that could improve the application of energy savings retrofits – the savings assured from performance agreements – essentially eliminating the capital risk through a performance contract. This has been used by energy service companies (ESCOs) for many years.	The proposed BM is a good fit when an organisation is changing from developing component level solutions, such as ballasts, fixtures, lamps and controls, to providing complete integrated lighting solutions for building energy efficiency retrofitting. However, it doesn't show what constitutes the new BM.
Wikström et al. (2010)	No clear definition of BM	Value and flexibility Organisational entity Innovation and growth mechanisms. Competence and critical assets Relationships and collaboration mechanisms	The paper explores the 'particular requirements, characteristics and combinations of business practices in project business.'	The paper uses the BM concept as inter-organisational activity that shows the power of value networks. However, the paper doesn't investigate what is BM and how it changes and the cause of value creation.
Wong, Thomas, Ng, & Chan (2010)	No clear definition of BM	No clear BM elements	'Timely diversification and appropriate adjustments in BM are vital to manage transformations and changing business environment of the construction industry. For instance, the bulk of base workload in Hong Kong has changed from capital investment to repair, maintenance, alteration and addition works; urban renewal; environmental improvement; and heritage construction'	The paper proposes multi-directional alliancing through the entire value chain in order to enhance the companies' market and develop the construction industry in Hong Kong in a sustainable manner, but there is no clear definition of BMs and their elements.
Tykkä et al. (2010)	No clear definition of BM	No clear BM elements	The paper addresses the essential question 'Has EU construction policy innovation contributed to innovation at the firm level?' The results show that timber framed firms have become actors in the construction industry. They made the product, process and organise innovations, including close communication of customers to production processes.	Although the authors draw on their study of timber-framed firms in six European countries and identify new business, no definition or explicit description of the business model was provided.

Author/ Year	BM definition	BM elements	Contribution of the Study	Gap
(H. Li et al., 2009)	No clear definition of BM	No clear BM elements	Little has been written addressing the competitiveness of real estate companies in China. Thus, it is essential to study the factors that influence competitiveness in the real estate market in China.	No mention of the sustainable value that comes from the new BM. Also, the paper presents the factors that influence competitiveness in the real estate companies' BM, but with no definition of the BM or its elements.
(H. G. Chen, Zhang, Li, & Qiang, 2009)	'Business models mainly relate to basic profit business ways, objects and contents of service'.	No clear BM elements	The paper identifies the concept of electronic business focussing on reality practice in construction enterprises for application foundation of electronic business models.	No mention of sustainable value from the new BM. Although the paper presents a definition of BM, it works specifically for electronic business. Also, the paper kept salient about what constitutes the BM.
(Boddy, Rezgui, Cooper, & Wetherill, 2007)	No clear definition of BM	No clear BM elements	The paper argues for a re-focussing on support for process in CIC research for construction.	No mention of the sustainable value from the new BM. Also, no definition of BM or its elements.
(Brady, Davies, & Gann, 2005)	'an integrated solutions business model' is developing new approaches to creating a customer value, building new capabilities specially in systems integration and connecting learning to allow the firm to exploit financial prudence.	Value Proposition and adding value Building capabilities Value creation Customer focus Competitive strategy by integrated solutions	The paper displays the integrated solutions as the future of the construction industry.	No mention of the sustainable value from the new BM. Although the paper presents a definition of the BM, it works specifically when adopting integrated solutions BM.
(Seaden et al., 2003)	No clear definition of BM	No clear BM elements	This study highlights the principal outcomes and extends the analysis of strategic management process regarding innovation in construction firms.	No mention of the sustainable value from the new BM. The paper describes linkages between business environment, business strategy, innovation practices, and business outcomes. However, it refers only to what is the basis of BM, and no BM elements are introduced.
(Duyshart, Walker, Mohamed, & Hampson, 2003)	BM for ICT is: Achieving an innovative approach to realising value for money through demonstrated efficiencies and improved service quality through the supply chain.	The paper adopted a framework from another business and management study by Hampson et al. (2001).	The effective use of ICT is essential for delivering efficiency and enhancement in the delivery of the projects and practices in the construction industry. The 'ability to develop sound ROI calculation for expenditure on ICT was a dilemma particularly in the conservative construction	No mention of the sustainable value from the new BM. Also, the study gave a definition of the BM for the ICT but it didn't identify what constitutes the BM and the BM is only for ICT.

Author/ Year	**BM definition**	**BM elements**	**Contribution of the Study**	**Gap**
			industry' (Duyshart et al., 2003, p. 179)	
Anumba & Ruikar (2002)	No clear definition of BM	No clear BM elements	The paper reviews the developments in e-commerce in the construction industry, with a specific focus on its applicability and uptake within the construction industry	The paper doesn't define BM or what constitutes the BM.
Cheng, Li, Love & Irani (2001)	No clear definition of BM	Value added: a virtual network structure Partnering: with agreement in risk. Financial cost.	The paper identifies that construction industry is fragmented, resulting in poor communication and insufficient information, a practice that has added to the rise of dysfunctional supply chains. Proposing new virtual networks that act as a new value added of the e-business to improve communication and coordinating and encourage the mutual sharing resources.	No mention of the sustainable value coming from the new BM. Although the paper presents the BM elements needed for the BM, it doesn't include what is the new BM.

In the above literature, keywords in the BM concept relating to the construction industry are support, improve, change, encourage, share, applicability, uptake, transition, operational efficiency, opportunity, transform, reconceptualise, process, investment stability and cost reduction. Five overall themes emerge from BM construction literature. Figure (3-7) below shows the word frequency query result from the systematic literature review.

Fig 3-7: Word frequency query from SLT for BMs from 2000-2018

Summary of the themes showing there are five themes: a) E-business BM; b) Project and Firm level BMs; c) Product-based solutions; d) Holistic sustainability-oriented BMs; and e) Green BM-related environmental sustainability. These themes will be broken down below with further explanations.

- **BMs in Building and Construction as E-Business initiatives**

The first theme recognised in the literature of BMs in the construction industry is that related e-business activities need internet and e-commerce, enabling technologies to create new organisational structures, such as merchants, customers and e-commerce interfaces. Growth of e-business sector in the early and mid-nineties helped researchers to identify BMs and describe those using BM elements. At this stage, the term 'Business Model' and the BM concept were equivalent to value created only by e-businesses and e-commerce industries. Therefore, BM conceptual development in the construction sector was largely unknown (Wei Pan & Goodier, 2012).

Industry-wide recognition of BMs as a tool to measure value creation was first noticeable after the e-commerce revolution. Scholars have studied the concept of BMs primarily in relation to e-business, ecommerce, information and communication technologies (ICT), Computer Integrated Construction (CIC), and Information Technology (IT) (Anumba & Ruikar, 2002; Cheng et al., 2001; Duyshart et al., 2003). The BM in these articles has evolved as a tool to support business processes, innovation, identification of opportunities and conceptualisation of business concepts. BMs in the construction sector can be found in the 20th century. By then, BMs in e-business, e-commerce and CIC were well-developed (Cheng et al., 2001).

Cheng et al. (2001) discovered value-added components in the construction supply chain using an e-business BM. An e-business model shows how construction companies adopt e-business technologies as tools to transform traditional contracting relationships into networked relationships. Using networked contracting relationships, project participants were able to achieve better responsiveness, cohesiveness, flexibility, compatibility and interoperability in the entire project development lifecycle (Cheng et al., 2001). Adoption of an e-business model has not replaced traditional contracting relationships but has evolved the networked contracting relationship concept using a shared pool of resources in limelight. According to Anumba & Ruikar (2002), the construction industry in the early 2000s needed change, and possible ways to achieve this were with innovation, strategy and process changes. This gap led to the identification of barriers to implementation of e-commerce-based BMs. Anumba & Ruikar (2002) visualise a networked contracting relationship design proposed by Cheng et al. (2001) in e-commerce applications in a way that brings consumers closer to administrative activities. The new-found category was possible due to the use of e-commerce technologies, existing Business-to-Consumer (B2C) and Business-to-Business (B2B) relationships. Duyshart et al. (2003) discusses the failures of traditional economic assessment techniques that did not measure soft factors such as quality, convenience and reliability. Better assessment could be achieved by working closely on customer satisfaction ratings resulting from investments in ICT. Leveraging the advancements in ICT technologies, project site teams benefitted from improved communication and saved travel costs. This led to the idea of a BM for ICT by adopting the alliancing procurement approach to deliver the final project (Duyshart et al., 2003).

Seaden et al. (2003) uses the competitive advantage business model in their study, which was criticised for its theoretical definitions by Pan & Goodier (2011) when measuring innovation in firms. The focus remained on process innovations or strategic decision-making processes within construction companies, which were linked to innovativeness and measured in terms of adopted technologies. Therefore, Seaden et al. (2003) manages to describe linkages between environmental and business strategy variables, associate them with firm-level innovativeness and measure profitability and competitive advantage. Brady et al. (2005) examines integrated solution BMs in the construction industry. According to Brady et al. (2005), integrated solutions as value-based system integration are capable of bringing value to customers by creating a built environment that meets their personal and social needs. However, these views lack theoretical foundations (Brady et al., 2005) and a holistic view of construction lifecycle is warranted. Brady et al. (2005) recognises the need to develop new approaches to creation of customer value, particularly in the area of systems integration; however, the study fails to discuss BM literature, green business models, environmental, social and economic sustainability, which would make a compelling case for integrated solution BMs to work successfully in the construction industry. Similarly, Boddy et al. (2007) recognise the delay in IT adoption in the construction sector. Boddy et al. (2007) argue for the use of CIC – an umbrella term for IT and ICT enabled technologies – in BMs to potentially improve gains such as productivity and quality. Likewise, Brady et al. (2007) develop a streamlined approach to data management, with use of computer networks, hardware and software in the construction industry. A data information model is presented in the construction landscape as an approach for meeting computing requirements in the construction industry. A CIC-oriented BM has elements that envisage e-commerce and e-business models. However, Boddy et al. (2007) do not review a BM definition or BM elements that play a role in CIC design or in achieving sustainability.

In the discussion of emerging e-business models, Chen et al. (2009) propose a model that encourages transformation from traditional BMs to electronic BMs for adoption by construction enterprises. They identify B2B activities, such as bidding and tendering, which are the main activities in large-scale construction projects. They also identify a few B2C activities, like management of a web portal under electronic business models. The research on ‘reality practices in construction’ (Chen et al., 2009) does not mention where value comes from. It also fails to identify BM elements in the e-business model. The last research thesis reviewed under the e-business model is by Li et al. (2009). This reiterates the need to identify and rethink BMs in construction companies in order to create competitive advantage in the market. While Li et al. (2009) has provided a theoretical basis of the factors that influence competitiveness, the BM identification and transformation is implied from earlier studies (Anumba & Ruikar, 2002; Boddy et al., 2007; Duyshart et al., 2003).

Under the first theme, there was evidence of growth of BM literature in the construction industry between 2000 and 2010. However, there are limited examples addressing the need to design and rethink BMs and identify BM elements. Preliminary studies (from 2000 to 2010) in BM design and development led to innovations in BMs at firm level, project level and product level, which are presented in the next section.

- **BMs in Building and Construction at the Project and Firm level**

Second theme studies on BM literature continued to evolve, as seen in the case of firm-level (Pekuri et al., 2013) and project-level (Mutka & Aaltonen, 2013) instances. The new BM definitions separate BM from business strategy. According to Casadesus-Masanell & Ricart (2010), cited in Mukta & Aaltonen (2013), 'a BM can be described as the way a company operationalises its strategy to concrete business activities or initiatives.' BMs of construction companies present a reflection of the firms' strategic decision-making tools and methods for achieving competitive advantage through BM adoption. The papers (Mutka & Aaltonen, 2013; Pekuri et al., 2013; Wikström et al., 2010) have established a consensus on the impact of BMs as a tool for generating and articulating plans for profiting from innovation or by adopting new and emerging technologies. Despite evidence of literature on BMs in construction at firm or project level, the theme of sustainability does not emerge in BM design. The studies (Mutka & Aaltonen, 2013; Pekuri et al., 2013; Wikström et al., 2010) were unable to conceptualise or develop a BM development framework that could allow construction companies to sustain the value creation, delivery and capture processes. There was no discussion on the changes needed in BM design that could lead to sustainable value for consumers of construction projects.

According to Wikstrom et al. (2010), performance-based firms have the ability to create linkages across BMs of different firms using integration and collaboration mechanisms. Also, inter-organisational BMs lead to partnering, which can be a form of competitive advantage. Thus, if BMs are differentiated to fulfil customer needs and hard to replicate (Pekuri et al., 2013), it could result in competitive advantage (Morris et al., 2005; Teece, 2010). BMs become tools that managers can use to link business strategy with operations (Sommer, 2012). This view of model adaption helps mangers to describe and design the activities required to create value for customers and stakeholders. However, managers have demonstrated limited understanding of their companies' current BMs, leading to modest transformations in the business models and failure to change them at the right time (Johnson & Christensen, 2008; Pekuri et al., 2013).

Instances where projects are independent of business organisations and have goals that differ from those of the parent firm can impact on project delivery (Mutka & Aaltonen, 2013). Similarly, Mutka & Aaltonen (2013) argue that BMs of Project Based Firms (PBF) are used to derive project-level BMs, which is similar to a top-down structure. However, BMs of projects in PBFs also have a bottom-up effect. They shape firm-level BMs and create dynamic relationships. The role of a manager, an idea discovered in Wikstrom et al. (2010), extends to PBFs such that managers need to understand the BM of their firm and transform it to project-level value creation ideas (top-down) while bringing key elements from project-level BMs to a firm-level BM. The framework in Mutka & Aaltonen (2013) is adopted from Osterwalder (2004) for a PBF. Similarly, Mutka & Aaltonen (2013) have presented the concept of BM as a unit of analysis for examining whether project-level goals can be determined by firm-level objectives, and whether project BMs can potentially influence firm-level goal setting. Pekuri et al. (2013) reviews managers' understanding of a BM and how they apply organisational-level BM concepts in construction. The BM definition is developed at company level to organise value creation and capture mechanisms for customers. Pekuri et al. (2013) uses qualitative methods to gather data from the construction industry in Finland. The results (Pekuri et al., 2013) develop and strengthen the ideas in Wikstrom et al. (2010) and Mutka & Aaltonen (2013), where managers were unable or found it difficult to describe the firm or project level BMs and value creation logic.

Based on the above theme, it can be said that managers need to review their BMs at project or firm level for better coordination and implementation activities. Although Mutka & Aaltonen (2013) explicitly define BM in their study, Pekuri et al. (2013) and Wikstrom (2010) have not given a clear definition of their selected business model. While some authors clearly list the BM elements identified, there is no evidence of sustainability, sustainable BMs or discussion on elements that transform BMs. Review of the above studies only indicates the existence of a firm or project-level BM view in the construction sector.

- **BMs in Building and Construction as Product-Based Solutions**

The third theme relates technological improvement-led new business models in the construction industry, such as OSC (Pan & Goodier, 2011), Industrialised Buildings (IB) (Brege et al., 2014), Timber-Framed Constructions (TFC) (Tykkä et al., 2010) and Radio Frequency Identification (RFID) technology in construction materials and components reuse (Iacovidou et al., 2018). The authors under this theme have mainly compared existing solutions with construction in the housing sector and discovered the underlying BMs during this process. The authors have highlighted the need to create a market position and profit from delivering projects using a product-oriented approach. Although the term BM is implicitly defined in these studies, authors have developed a strong relationship between BMs and construction activities. The merit of these studies is in emphasising the need for BMs while taking up new concepts such as OSC, IB, TFC and RFID in a product-solution type of approach within the construction industry.

- **BMs in Building and Construction for Sustainability initiative**

The fourth theme of sustainability-oriented BMs has been seen over the last five years. Literature evidence is beginning to identify initiatives needed for sustainable development and for achieving sustainability through BMs. Although this theme was the first significant move in understanding and bringing sustainable development from business and management research into the construction industry, no clear projects address the underlying social, environmental or economic issues.

The concept of value networks is proposed through alliancing techniques (Wong et al., 2010). Within this theme, sustainability is viewed as an integral part of BM transformation, creating the much-needed clarity on moving towards sustainable BM development. Wong et al. (2010) discusses the fluctuations in construction volume leading to unsustainable development in construction projects. The study further suggests alliancing as a new form of BM between Small and Medium Enterprises (SMEs) and large firms to seize business opportunities.

Wasiluk (2013) observes the use of intellectual capital (IC) as a driver of organisational-level changes and bringing sustainability to BM development. However, a clear adopted definition of a BM was absent. According to Wasiluk (2013), implementing sustainable development in business requires the embedding of sustainable practices in all IC categories – economic, environmental and social. Aho (2013) has a similar view to that of Wasiluk (2013), which incentivises the provision of operating services using a long-term view, and allowing the construction sector to ensure investment stability by moving away from short-term gains. Despite advocating a strong link between professionalism and sustainable housing, the study does not discuss processes that reward the people, company or firms responsible for adding value in construction projects. The studies (Aho, 2013; Wasiluk, 2013) highlight the importance of embedding sustainability in BMs from an individual or business perspective by reducing short-term, profit-oriented and capital intensive activities and focussing on long-term, performance-oriented and value-adding processes, while rewarding the people and firms involved in such activities.

- **BMs in Building and Construction for Environmental Sustainability initiatives**

The last theme on sustainable construction is a discussion of green BMs. This theme was found alongside growing literature on BM solutions for issues concerning environmental protection, waste reuse and effective use of materials in resource-constrained scenarios. The researchers (Abuzeinab et al., 2016; Mokhlesian & Holmén, 2012; Sweetser, 2012; Zhao et al., 2017, 2016) discuss specific areas, such as green BMs, innovative BMs, material reuse and environmental sustainability challenges. Keeping current environmental conditions in view, the authors identify the need to suggest green products, using environmentally-friendly materials, in the construction supply-chain, and bringing new and innovative ideas, such as eco-fuels, component recycling, material re-use, energy efficiency, RFID-based storage and tracking concepts, lifecycle management concepts and eco-innovations, into real-life applications.

According to Mokhlesian & Holmén (2012), a business creates and delivers value to its customers based on the structure of costs, revenues and profits. The objective of the study is to highlight green construction and to address problems relating to construction of sustainable buildings, primarily profitability. The study also presents the importance of balancing risks and benefits in construction projects, which allows firms to transition cautiously towards sustainable development. Mokhlesian & Holmen (2012) have depended mainly on current literature sources to list BM elements that need to change in traditional construction companies to enable those companies to adopt environment-friendly construction processes. Sweetser (2012) complements the ideas in Mokhlesian & Holmen (2012) by taking up the problematic area of high assessment costs in achieving improved energy retrofits of existing buildings. The study emphasises growing energy costs, inefficiencies and wasteful practices in energy use by addressing these problems through BMs that remove capital risk and train and educate energy service companies (ESCO), customers and stakeholders, and adopt a set of sophisticated modelling to design new buildings and retrofit existing ones. However, Sweetser (2012) also fails to include an explicit definition of BM or its elements, which could provide much-needed clarity for BM transformational elements.

BM transformations, using environmental technologies to convert them into commercial value under the term ‘Zero Carbon Building (ZCB)’ or Net ZCB, was presented recently (Zhao et al., 2016). The elements of a BM framework, discussed by Zhao et al. (2016), converges towards ZCB development issues, keeping environmental design-related changes at the forefront and choosing not to include, or take into account, the social and economic inputs. One of the challenges mentioned in Zhao et al. (2016) on the slow uptake of ZCBs in society can be answered by Aho (2013), who argues that for ‘long-term sustainability (a key client requirement for ZCB), construction companies need short-term profitability’. Thus, ZCB is a novel approach but: a) it does not cover social or economic sustainability issues (Wasiluk, 2013) through BM development; b) building ZCBs with net zero energy costs requires significant changes in stakeholders’ (client, construction company, financing agency) mind-sets, changes in BM designs and effective management of risks, as ZCBs would need long-term strategic planning to pay-off stakeholders. Although Zhao et al. (2016, p. 275), reiterating Schaltegger et al. (2016b), maintains that it is possible to ‘create customer and social value by integrating social, environmental and business activities’; however, this focusses only on the process of business model innovation for ZCB and misses out on making a business case for social and economic sustainable development opportunities.

According to Abuzeinab (2016), BM transformation in UK construction companies needs environmental sustainability to achieve economic success in future. However, there is no mention of social sustainability or the changes needed in the construction sector to meet social development, such as jobs, healthcare or community development. The focus of the study (Abuzeinab et al., 2016) on greening BMs is similar to green construction projects BMs, presented by Mokhlesian & Holmén (2012); sustainable development using green materials (Wong et al., 2010), green building ratings (Wasiluk, 2013) and ZCBs (Zhao et al., 2016). Abuzeinab (2016) proposes alignment of BM activities to encourage construction managers to adopt green practices, but the focus is restricted to improving environmental and economic positions in the construction value chain. Furthermore, Abuzeinab (2016) proposes a five element BM design, which includes green value proposition (GVP), target group (TG), key activities (KA), key resources (KR) and financial logic (FL).

The literature over the past ten years has provided directions on selecting the right mix of elements to achieve sustainability in BM development. Ideas on BM transformations using alliancing (Wong et al., 2010), ESCO (Sweetser, 2012), green value propositions (Abuzeinab et al., 2016), smart technologies in construction (Iacovidou et al., 2018), long-term business strategies (Zhao et al., 2016) and BM innovation (Zhao et al., 2017), Wong et al. (2010), Abuzeinab (2016) and Zhao et al. (2017, 2016) make a compelling business case for adopting sustainable practices in the construction BM. However, there is limited knowledge on sustainable BMs in the construction and housing industries. It is important to create a framework that uses key sustainable elements from literature to address the three areas of sustainability (social, environmental and economic) in the process of creating the organisation's BM. Conceptualisation of SBMs will allow HCCs to enhance long-term value for their customers, address environmental problems such as energy costs and clean energy, and help their stakeholders gain value through strategic development.

3.3.1 Summary of BM Approaches in the Building and Construction Industry

In the last theme, a clear shift of view from BM design at firm level or project level is transformed into specific areas in the form of products that meet client requirements. The literature presents some core areas of BM design development in the construction sector. However, building processes and activities constitute crucial components of BMs, both project delivery mode and company structure. The BM deals with the logic of investing in innovative ideas such as ZCB, keeping sustainability issues in mind and managing future profitability. It reflects how value propositions are designed, identifies targeted customer segments and the underlying financial logic. No exhaustive studies on the changes needed in common BM transformations have been found except in relation to projects of energy retrofitting (Mokhlesian & Holmén, 2012; Moschetti & Bratteb, 2016). Enterprises must collaborate with scientific communities to deliver sustainable buildings from a BM perspective (Mokhlesian & Holmén, 2012; Wong et al., 2010). Transforming a conventional BM into a SBM entails the presence of certain elements to achieve the three dimensions of sustainability. Aho (2013) suggests five elements: value proposition, customers, resources, capabilities and revenue streams to bring added-value to sustainable construction. Likewise, Mokhlesian & Holmen (2012) have adopted nine elements that provide green solutions; namely, value proposition, target customer, customer interfaces, customer handling, value configuration, capability, partner network, cost structure and revenue model. The five basic elements adopted by Abuzeinab (2016) function within the firm, but to create a green BM, elements that lie outside the firm should be engaged (Mokhlesian & Holmén, 2012) to develop sustainable value propositions that can be marketed to target groups in order to create revenue streams. Construction companies could identify value capturing mechanisms through this process (Aho, 2013). Therefore, development of new business models that create and capture value from a long-term, lifecycle view is a significant research challenge. According to the previous studies of BMs found in the literature, a proposed sustainable business model definition will be produced to clear ambiguity.

3.1	**3.2**	**3.3**	**3.4**	**3.5**	**3.6**	**3.7**	**3.8**	**3.9**	**3.10**
Introduction	Review of BMs in Business and Management literature	Review of BMs in Building and Construction literature	Summary of BM and development of SBMs Definition	SBM elements in Building and Construction	SBM for the Housing Construction industry	Relationships between the concepts	Boundary/Scope of the Study	Conceptual framework	Summary

3.4 Linking BMs Approach with Sustainability in the HCI

This section suggests that a SBM has the potential to bridge the gap between upstream and downstream stages of the implementation of sustainability in the HCI, offering win-win solutions for multiple stakeholders to meet the economic, social and environmental benefits when developing BMs for future growth. These benefits can be realised on multiple domains, as follows:

- Economic: benefits for the developers (e.g., sustainable building accreditation, fast delivery, and new market opportunities), the customers (e.g., quality project, cost efficient, affordable, certified building and lower bills), operators and distributors (e.g., new business opportunities and new contracting models)

- Environmental: benefits for the developers (e.g., pollution reducing and prevention, reduction in carbon emissions, efficiency in use of materials using strategies such as recycling, reusing and renovation), the customers (e.g., air quality and biodiversity).
- Social: benefits for the developers (e.g., worker safety and opening new jobs), the customers (e.g., sense of community, accessibility, quality of life).

Drawing from studies explored in the last twenty years, the following key issues have driven use of the concept of the BM in the construction industry:

- Lack of new technology adoption
- Inefficient use/overuse of materials (concrete, iron, building tools, transportation)
- Weak communication links between developers and end-users
- Weak information availability over the whole supply chain
- Flexibility to partner, cooperate and collaborate with external firms
- Test innovative designs at low risk
- Distribute costs, earnings, value and risks across participating groups

Based on the above issues and discussion on the BM approach, and emergence of sustainability initiatives, which have repeatedly emerged in the last decade, the field is still at an early stage, and there is little in the literature at the present time to provide a comprehensive review. To develop a SBM definition, it is vital to include the integration of environmental and social goals into a broader definition of value in business activities (Schaltegger, Hansen & Lüdeke-Freund, 2016). There appears to be agreement among researchers into the SBM approach that SBM is achieved not only through new technology or innovation, but that the model must include customer participation in capturing value (Teece, 2010; Zott, Amit & Massa, 2011), while the company's role involves achievement of SDGs by delivering economic, social and environmental benefits (Evans et al., 2017). Additionally, the systematic review provides an overview of different ideas and approaches associated with the development of the SBM see table (3-2). Therefore, based on this analysis, this study defines a SBM approach for the HCI as:

A plan for the housing construction company to provides socio-environmental improvements and economic benefits by focusing on sustained value creation with clients'/participants' roles at the core and by incentivising and engaging them in the value chain within the project delivery processes. Hence, the SBM represents the way HCC create, deliver and capture value by addressing customer needs and upholding social, environmental and economic principles for the long-term benefit of organisations.

Next section will discuss the elements needed for the development of SBMs.

3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	3.10
Introduction	Review of BMs in Business and Management literature	Review of BMs in Building and Construction literature	Summary of BM and development of SBMs Definition	SBM elements in Building and Construction	SBM for the Housing Construction industry	Relationships between the concepts	Boundary/Scope of the Study	Conceptual framework	Summary

3.5 SBM Elements for the HCI Transformation

The use of a BM concept in building and construction literature is used to define value-capturing mechanisms and to present a framework for defining value (Mokhlesian & Holmén, 2012). Therefore, BMs constitute a) a set of common attributes found across all BMs since e-Business Models and b) another set of attributes that are specific to the business environment in which the construction firm operates. According to Pekuri et al. (2013), most studies have proposed different definitions and uses for BMs, but similarities can be drawn across referenced literature samples. The methods used to prepare a classification of BM elements based on theoretical frameworks (Mutka & Aaltonen, 2013), Corporate Sustainability (CS) frameworks (Wasiluk, 2013) and process-based frameworks (Abuzeinab et al., 2016; Zhao et al., 2016) is illustrated in table (3-3). Elements from each of the selected studies were listed and compared with elements from other studies. The elements were grouped into categories that were similar to each other across the selected list of articles. The analysis resulted in four distinct categories or themes, with nine BM elements under each category. The list of BM elements forms the business model framework used in this study. The elements are (1) Value Proposition, (2) Target Customer, (3) Distribution Channel, (4) Customer Relationship, (5) Value Configuration, (6) Key Resources, (7) Partner Network, (8) Cost Structure and (9) Revenue Model.

Table 3-4: BMs Elements identified in the Articles in the Building and Construction industry reviewed from 2000-2018

Business Model Elements		**Cheng et al. (2001)**	**Brady et al. (2005)**	**Wikström et al. (2010)**	**Mokhlesian & Holmén (2012)**	**Mutka & Aaltonen (2013)**	**Pekuri et al. (2013)**	**Brege et al. (2014)**	**Zhao et al. (2016)**	**Abuzeinab et al. (2016)**
Value Offering	Value Proposition	√	√	√	√	√	√	√	√	√
Customer Interface and Delivery	Target Customer		√		√	√	√	√	√	√
	Distribution Channel	√			√		√	√		
	Customer Relationship			√	√		√		√	
Value Creation	Value Configuration		√		√	√	√	√	√	√
	Key Resources		√	√	√	√	√	√	√	√
	Partner Network	√			√	√	√			
Value Capture	Cost Structure				√		√		√	√
	Revenue Model	√			√	√	√		√	

When the BM elements are discussed in the literature there is disagreement of what composes a BM. At the same time there is additionally disagreement to what is the sub elements of the BM elements. The chosen terminology for selection of an appropriate naming system for elements is found in Osterwalder et al. (2005), which is used repeatedly in literature. The BM elements have been slightly adjusted in Osterwalder & Pigneur (2010) by the development of a visual tool called a 'Business Model Canvas' to describe BMs and list BM elements diagrammatically. However, the BM elements do not change except in the way they are represented. According to Osterwalder & Pigneur (2013), a BM canvas is a tool to visualise, challenge and re-invent BMs. Dudin et al. (2015) state that a BM canvas provides a common language for scholars to discuss BMs, as definitions of BMs have been loosely defined across multiple disciplines. Selection of BM elements is based on the criterion that each element is mentioned in at least four of the review articles, overlapping significantly and suggesting that saturation was achieved using the above inclusion and exclusion criterion. At the end these elements are grouped into four sections. Namely "Value Offering" – including what value proposition is offering, "Customer Interface" – including the target customers and how does a firm get contact with the customers, "Value Creation" – including what resources, activities and partners does a firm needs and use, Value Capture" – including the cost and profits into and out of the business. High citation has been given to the offered value and the value creation elements. The description given below explicitly mentions the BM elements used in construction literature and implications for SBM development.

3.5.1 Sustainable Value Proposition

According to Osterwalder et al. (2005), a value proposition is the overall view of a company's bundle of products and services. A value proposition shows how a product or service solves a customer's problem, delivers benefits and improves their situation, all wrapped up in a simple compelling way that moves a customer to take action. Mokhlesian & Holmen (2012) describe a value proposition as something of value from the perspective of a customer. The term 'value' does not explicitly mention for whom value is created or identify the customers in this case. Similarly, Abuzeinab (2016) refers to value as a unique offering delivered by a firm to its customers. Although Zhao et al. (2016) do not define the value proposition clearly, they argue that a firm should know its internal processes and activities well enough to formulate a value proposition. Therefore, a value proposition is a short, specific statement, written in the customer's language, of what the customer values.

In the building and construction literature, for example, value propositions in off-site construction (Pan & Goodier, 2011), timber-framed construction (Tykkä et al., 2010) and industrialised buildings (Brege et al., 2014) list the products and services upon which a value proposition is built and describe how these products and features eliminate issues with housing (pains), like low energy efficiency or wastage of construction materials, and outlines the gains from innovative technologies, efficient use of raw materials and improved communication between developers and customers. Creating a value proposition has been partially successful in the construction industry because construction firms have only targeted the environmental challenges faced by customers through energy efficient solutions, such as retrofits (Sweetser, 2012), Green BMs (Abuzeinab et al., 2016) and ZCBs (Zhao et al., 2016), but there is no value proposition apart from Aho (2013), who targets customers' challenges in economic (low interest financing, energy subsidies) and social areas (needs, quality of life, jobs, community growth).

SBM provides a sustainable value proposition for customers by mapping and aligning their social, environmental and economic needs, desires and challenges and creating a proposition that holds those using resources that HCCs can produce and stay competitive. A Sustainable Value Proposition (SVP) for a housing construction firm must identify the housing needs, issues with housing projects (before, during and after) faced by customers and the outcomes and benefits that the customer expects or desires in housing; for example, maintenance, operation, functional utilities, social gains, positive emotions, energy and cost savings. A sustainable business model will create a sustainable value proposition by applying flexible plans and designs (Brege et al., 2014; Pan & Goodier, 2011) and innovative technologies (Boddy et al., 2007) to solve customers' problems and capture value for sustainable business development.

3.5.2 Target Customers

Target Customers (TC) are those for whom a business wants to provide value (Morris et al., 2005; Osterwalder & Pigneur, 2005; Shafer et al., 2005). Businesses need to ask which customers they are serving through their business. Having identified those customers, a firm can start creating a value proposition. Similarly, every customer segment targeted by a firm requires a different value proposition. A firm can start creating value by solving the problems and needs of its most important customer segments (Aki Pekuri et al., 2013). The term 'customer segments and target customers' has been used interchangeably with stakeholders (Mokhlesian & Holmén, 2012), end-user segments (Brege et al., 2014), clients (Aki Pekuri et al., 2013) and people (Wasiluk, 2013).

Target customers in the HCI are people looking for residential spaces with characteristics that meet their needs; for example, low running costs (Zhao et al., 2016), better services, such as heating and cooling (Brege et al., 2014), long-term financing options (Aho, 2013) and use of quality materials and smart technologies, both in construction and final product utilities. BMs of traditional HCCs have identified customer segments based on their financial profile; such as income, purchasing power, mortgage profile and job portfolio. Recent studies on BMs in construction refer to careful selection of customer segments (Mokhlesian & Holmén, 2012), changing customers' mindsets (Aho, 2013) and educating customers in relation to market orientation in the areas of their choice, or green buildings for enhanced reputations and the business development (Zhao et al., 2016). However, they do not identify customer segments based on the common problems they are facing.

SBMs differentiate target customers according to their personalised housing needs and the challenges they have encountered in building or financing houses by offering them value propositions best suited as solutions to their problems. For example, the target customers of people needing low energy costs over the full building lifecycle should differ from that of a customer seeking low upfront costs. A SBM will use a careful mix of modern and innovative techniques to design, build and operate residential housing according to the prioritised needs of each customer segment. Construction firms may need to rethink ways to identify target customers and offer them better value propositions that align their needs and desires with the three pillars of sustainable housing.

3.5.3 Value Configuration

Value Configuration (VC) is the arrangement of activities within a firm (Osterwalder & Pigneur, 2005). It is a flow of physical, intellectual and organisational inputs through a firm as it produces goods and services for its customers. Activities within a firm require different skillsets and physical resources. Value configuration describes how different parts of a firm are constructed and work together. It identifies the key activities, crucial in a business model, on which a firm should focus to create value for its customers. In literature, the term value configuration has been used interchangeably with inter-organisational activities (Mutka & Aaltonen, 2013) and key activities (Mokhlesian & Holmén, 2012).

VC in construction is described by Pan & Goodier (2011) as a house-building process that includes all activities – starting from land acquisition to finished and maintained dwellings. Construction firms aim to market or sell key activities to target customers in the form of value propositions. Activities in construction firms, such as land and materials acquisition

(Pan & Goodier, 2011), use of integrated technologies (Sweetser, 2012), materials and waste management (Mokhlesian & Holmén, 2012) and sale of complete units, outline how a firm operates and delivers value. A value proposition that maps customers' short- and long-term needs in housing, such as affordability, high financial savings and eco-efficiency, must be aligned with the best available value configuration that a firm can offer, and should reflect, at the same time, in the firm's value proposition. However, it has been observed that construction firms are unable to change their value configurations according to value propositions offered to customers (Mokhlesian & Holmén, 2012). In these circumstances, based on the SBM, a new innovative process will be applied, to produce a sustainable value proposition. This will focus on socio-environmental and economic advantages, highlighting social benefits, such as high customer satisfaction and occupant health and well-being (Zhao et al., 2017, 2016), improved productivity of workers and occupant health and well-being (Abuzeinab, 2015), environmental benefits such as improved indoor environment (Moschetti & Bratteb, 2016), lower carbon emissions (Zhao et al., 2016), energy efficiency and reuse of materials (Moschetti & Bratteb, 2016; Sweetser, 2012), modern methods of construction, such as offsite construction (Wei Pan & Goodier, 2012), prefabricated timber building (Brege et al., 2014), economic benefits, such as reduction of utility bills (Moschetti & Bratteb, 2016; Sweetser, 2012) and maintenance costs. These are sustainable solutions included in SBMs and targeted to meet customer need strategically. SBMs would enable HCCs to achieve efficient internal process management, risk evaluation and reduction; thus, balancing risks and costs associated with marketing sustainable value propositions.

3.5.4 Key Resources

Key Resources (KR) or capabilities are the skills, assets or means necessary to execute a company's BM (Osterwalder & Pigneur, 2005). According to Sommer (2012), capabilities are the people skills, technologies and equipment for using customer information and creating value in the form of products and services. The term 'capability; has been used interchangeably with business core (Chen et al., 2009), assets (Aki Pekuri et al., 2013), financial competency (Li et al., 2009), competencies (Aho, 2013) and core competence (Mokhlesian & Holmén, 2012; Pan & Goodier, 2011; Zhao et al., 2016). The capability of a firm is the availability of resources, knowledge, expertise, and routines. Knowledge sharing mechanisms improve cross-functional communication to create better value propositions and value delivery, thus improving competitive advantage. Key activities, built on cross-functional knowledge, are essential for creating value propositions and delivering value to customers.

According to Pekuri et al. (2013), identifying the capabilities of a construction firm requires managers to think about necessary activities for ensuring the needs of a customer are met. Executing any construction activity requires firm and project-level knowledge of materials and routines (Pekuri et al., 2013). Key resources in construction are land (Pan & Goodier, 2011), market research, people, technologies (Brege et al., 2014), maintenance systems (Zhao et al., 2016), building lifecycle management (Abuzeinab et al., 2016) and value engineering tools, which should be well-coordinated to work seamlessly and minimise wastage of resources. Finally, a firm's resources and activities constitute the underlying value proposition of a BM. In line with growing challenges to affordable housing, BMs will need to innovate key activities through knowledge management tools, and share newly-developed knowledge on sustainable solutions that could be put into practice in construction activities across the entire industry.

A SBM has addressed design issues, one of its key activities, through green design, but a similar view must also be adopted for economic and social activities; for example, using financial market research to maximise financial savings for customers, or building construction and maintenance using local labour, which helps in job creation (Aho, 2013). Firms can use this knowledge to benefit customers but understanding customer needs in the first place is important for sustainable solutions to work. Firms should adopt new capabilities that are likely to be tenable environmentally, socially and economically, and should provide viable revenue streams to enable firms to sustain them (Wasiluk, 2013). A SBM in the HCI will provide a visual tool with which managers can discuss and note customers' housing issues; can think, draw and test sustainable value propositions based on customer feedback, and can align key business processes and activities in a way that minimises environmental impact and maximises social and economic benefits while providing a steady revenue stream.

3.5.5 Partner Networks

According to Osterwalder et al. (2005), Partner Networks (PN) show the interconnectedness of cooperative agreements between companies that deliver and capture value. Therefore, a partner network is a supply-chain company, a marketing channel, or a logistical solution, depending on the needs of the firm, to create and fulfil its value proposition. According to Sommer (2012), partnerships are voluntary initiated cooperative agreements formed between two or more companies to create value for customers. Adoption of information systems and communication technologies (Duyshart et al., 2003) through BMs, can help firms – and their partner networks to a large extent – to create, deliver and capture value while making a strong case for partnering, alliancing, collaborating and even sharing business knowledge and resources in a common pool that will benefit all companies in the network value chain.

PNs are firms willing to share resources with each other through contractual agreements (Mokhlesian & Holmén, 2012). There is considerable scope for establishing innovation through partnering (Pekuri et al., 2013), alliancing or collaborating (Duyshart et al., 2003). For example, firms leasing construction equipment provide hardware resources upfront for a small profit from the sale of residential units developed by a parent firm. An information technology firm can partner with construction firms across the country and earn small shares of revenues from sales of land development contracts by a construction firm. An IT enabled firm will provide the technological support for B2B and B2C clients of the construction company and manage critical documents, such as service and contract agreements, and customer relationship tools, support website databases and information processing capabilities.

The SBM will be used to maximise the value partner networks bring to the parent firm, increasing the ability of the HCC, in this case, to create, deliver and capture value. Partner networks can potentially transform traditional construction companies into innovation leaders if they are willing to partner with firms offering new technologies (Chen et al., 2009), modern methods of construction (Brege et al., 2014; Pan & Goodier, 2011), lifecycle management solutions (Sweetser, 2012), green construction materials (Zhao et al., 2016), financing loans for big projects and leasing of complete structures. However, firms willing to partner must understand and acknowledge the difficulties of knowledge management, communication gaps and intellectual property issues across organisational boundaries. Partner networks greatly reduce the risk of HCC activities and create active interest outside the building and construction community. Partnering with firms can create competitive advantage as the SBMs value proposition helps to solve the problems of target groups while generating sufficient revenue streams for both the firm and its partners.

3.5.6 Cost Structure

Cost Structure (CS) is the total monetary value of all means employed in the BM (Osterwalder & Pigneur, 2005). The same definition appears in Sommer (2012) and similar interpretations are found, such as lifecycle cost (Pan & Goodier, 2011), cost-assessment (Sweetser, 2012), and total-cost (Aho, 2013) for different types of BMs. Cost structure can be expressed in two forms – as a sum of total value, or as a percentage of total cost. Cost structures are crucial for knowing how well a company can deliver value to its target customers and whether the value delivered is equivalent or higher than the cost at which the value was provided.

CS in a HCC relates to the total price of delivering all the housing products and services to target customers (Pan & Goodier, 2011). A traditional firm acquiring land, building units and outright transfer of rights will calculate costs differently from a firm engaging in life-cycle management of a building, including partnering (Mutka & Aaltonen, 2013), waste reduction (Zhao et al., 2016), waste reuse, and building as a product and service (Aho, 2013). Construction activities, firm resources and partner support represent costs and expenses to operate the business model. CS may seem simple and straightforward in a construction business, such as purchase of land, construction and sale (Wasiluk, 2013); however, in addition to the obvious costs (labour, materials and tools), expensive resources (land and materials) and key activities (foundations, waste removal, electrical installations) form the entire cost structure (Aki Pekuri, Pekuri & Haapasalo, 2015). Business managers will need to use design, management and accounting tools to map the cost structure. However, a BM view makes cost assessment easier to understand and map at strategic, design and assessment levels.

The SBM will benefit from cost assessment tools developed using new technologies and will depict the financial cost structure but with the goals of a) improving cost assessment by taking social sustainability impact into consideration and b) calculating costs incurred in creating a product (housing unit) and providing services (maintenance and repair, upgrades) (Sweetser, 2012; Zhao et al., 2017), and local labour engagement. When viewing a BM with the objective of turning it into a SBM, it is necessary to consider it as a functional system of interrelated components; changing one element of the BM will probably affect one or more further elements (Aho, 2013). Accurate cost assessment has many long-term benefits for construction companies, such as improved planning, accurate profitability and, thus. reduction of risk. However, green BMs have only been applied to improve assessment of environmentally sound concepts and have failed to measure social and economic impacts and, thus, costs. According to Aho (2013), a BM can become a SBM following changes in its cost structure element, provided that the cost structure can measure social costs; for example, jobs created as a result of a new construction project, to a good extent, and taking a life-cycle management view from an economic standpoint.

3.5.7 Distribution Channel

A Distribution Channel (DC) or customer handling channel describes the ways in which a company gets in touch with its customers (Osterwalder & Pigneur, 2005). From a customer's viewpoint, a distribution channel describes the way each customer would like to be reached. Channels form direct and indirect links and ways for customers and businesses to communicate. According to Cheng et al., (2001), a firm must spend time and effort in creating strong channels with the customers.

DCs in construction are ways in which a construction firm reaches its customers; for example, through its physical offices (Mokhlesian & Holmén, 2012), land-development sites, online websites, print and news media. While marketing channels only seek to engage customers with the objective of selling products or services, channels must be viewed as a medium to reach customers in order to identify the jobs they need to have done, the problems they are experiencing and the benefits they are seeking from those jobs or activities. Construction firms can return with this valuable knowledge to create value propositions based on their value configurations, capabilities and partner networks, such as off-site construction (Pekuri et al., 2013). Distribution channels describe how a construction firm's end-products reach its customers. A simple service that a construction firm can provide using its distribution channels could be relocation, transportation and shipping. A construction firm should identify: a) ways in which they reach target customers; b) whether or not channels are integrated; and c) which channels are the best and most cost-efficient in order to become sustainable.

SBM development will help firms recognise the channels they are using currently to reach the right target customers. This understanding will have the following impacts: a) construction firms can remove, modify and create channels to reach customers more effectively; and b) clarify whether those channels could use sustainability principles, such as environmental (using services from green energy companies), social (education of employees) and economic (regulatory) incentives to promote and market the firm's products and services. To transform a BM into a SBM, distribution channels will need to adapt according to customers' changing preferences; for example, a construction firm with a website, mobile app and on-site services could share progress on project completion, value of property prices on a given date and important news that may interest a customer.

3.5.8 Customer Relationships

According to Osterwalder (2005), Customer Relationships (CR) explain the types of links a company establishes internally and with its target customers. Sommer (2012) describes customer relationships through the interactions that exist between the brand and its users. A focus on customer relationships may help to identify ways to attract and retain customers and help grow customer numbers (Mokhlesian & Holmén, 2012). From a BM point of view, attention to customer relationships helps to identify the type of relationship a firm has with different customer segments. Firms can have personal relationships (expensive products) or personalised relationships, but a BM helps to match relationships with appropriate customer segments.

CRs in the construction industry have been highly personal due to the expensive nature of a building, home or living unit (Mokhlesian & Holmén, 2012). However, building companies have failed to create personalised relationships; for example, suggesting what design to choose, what technologies to adopt and lifecycle services that will solve customer dilemmas and bring the benefits customers seek from their investments.

A SBM can help identify the nature of customer relationships in order to help a firm understand how to scale and modify those relationships to deliver better value. Relationships need modification to improve the effectiveness of the supply chain (Mokhlesian & Holmén, 2012), integrate customers with construction processes (Pan & Goodier, 2011) and try to change their views (Sweetser, 2012) from short-term gains to long-term benefits through adoption of environmental, social and economic sustainability concepts. Sustainable customer relationships will mean long-term profitability for HCCs and their partners. Customer relationships will develop with constant feedback from customers, thus improving value creation and delivery. Devoting time and effort to turning ordinary relationships into interactive discussions about building plans, designs and problems to be resolved in relation to customers' housing needs will turn associations into sustainable alliances.

3.5.9 Revenue Model

Osterwalder et al. (2005) describes the Revenue Model (RM) as a way for companies to make money from different revenue flows. According to Johnson et al. (2008), the revenue model is a blueprint for value creation and value delivery. The revenue model shows what the companies or customers are willing to pay in exchange for a product or service. Revenue streams can bring competitive advantage to a firm by measuring the cost of value paid by a customer and methods used for collection of payments from a customer (Mokhlesian & Holmén, 2012).

RM sources in construction can come from direct payments and long-term payments with interest (Aki Pekuri et al., 2015). Customers require multiple options and sources to pay for products and services from construction companies. Likewise, a construction firm must be open and adaptable to collecting revenue using different modes of payment (Mokhlesian & Holmén, 2012). Therefore, a BM is necessary for identifying the sources of revenue collection for a company. According to Aho (2013), flexibility in revenue collection and mode of payments from clients will enable construction firms to retain customers.

SBMs focus not only on short-term economic benefits but also on long-term social and environmental benefits. At the same time, they can improve revenue streams by identifying traditional ways to collect payments from customers and discovering whether a firm can reduce customers' concerns while making payments. The sustainable revenue model can help customers by including agreements with banking organisations, institutionalised lenders and cooperative banks at lower rates of interest than market prices. Alternatively, revenue models can include new, multiple and innovative solutions, such as customers repaying the value created by the firm in exchange for an equivalent value that a firm may desire outside traditional buying and selling. For example, a solar company installs photo-voltaic solutions for the energy required in a house for a fractional cost and, in return, the excess energy is bought back by the energy company. For this, a contract must be agreed between the customer, the solar and energy companies. A SBM will help firms come together by creating value for multiple stakeholders and forming relationships that are closely-knit with an equal partnership and bearing of risk.

3.5.10 Summary of the SBM Elements

The BM approach is a useful tool for organising the way a business creates, delivers and captures value. This model works at strategic, management, design and operational levels. Value propositions, when sustainable, can help solve customer problems by understanding their needs and proposing solutions that a customer understands and accepts. Interaction between a firm and its customers is a vital key for understanding customer needs and segmenting them according to their concerns and desires with respect to housing and construction. A value proposition is built on a firm's value configurations. Value can be created only when a firm performs activities based on the underlying value proposition. A firm can expand its capabilities by engaging partners from outside the industry to share risk and rewards of sustainable value creation and delivery. The cost structure of a SBM will accurately measure social, environmental and economic costs for a business to stay profitable and operational in the revenue model. Construction firms can review their existing distribution channels to identify target customers and engage them holistically. Firms need to learn how to attract, keep and grow customer segments by valuing and treating each customer relationship differently. Healthy relationships will impact a firm's revenue model as customers will have a strong affinity with businesses that use SBMs for value creation.

3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	3.10
Introduction	Review of BMs in Business and Management literature	Review of BMs in Building and Construction literature	Summary of BM and development of SBMs Definition	SBM elements in Building and Construction	SBM for the Housing Construction industry	Relationships between the concepts	Boundary/Scope of the Study	Conceptual framework	Summary

3.6 Sustainable Business Model for the HCI

Devoting attention to, and focussing on use of, BM as tools for business development can address challenges and maximise opportunities for a SBM in the HCI, as highlighted in the PESTEL analysis in the previous chapter. Prospects for SBMs are beginning to improve as natural resources are nearing exhaustion globally and price volatility of non-renewable sources are subject to extreme fluctuation (Iacovidou et al., 2018; Moschetti & Bratteb, 2016). Aho (2013) suggests that a research gap exists in the alignment of industry structure with sustainability objectives. According to Aho (2013), sustainable construction research focusses on design strategies, tools and processes by developing innovative systems, products and services, but this approach fails to identify the impact BM transformation can have on conventional BMs. The focus should be on these conventional BMs to make them sustainable and profitable. SBMs can help to leverage the functional elements to make a strong case for sustainability in the HCI. First, the SBM creates demand by understanding customer needs before creating value propositions, and responds by offering value through sustainable products and services, which are reflected in their value propositions (Teece, 2010). Therefore, firstly, a SBM directly relates to knowledge of HCI on demand and to opportunities and challenges in meeting any deficit (Lowe & Oreszczyn, 2008; Osmani & O'Reilly, 2009). Secondly, the SBM introduces the concept of creation of a deep understanding of a user (Teece, 2010). This view is contradictory to business and management literature, which maintains that product innovation itself can alleviate a customer's concerns; hence, no customer involvement is necessary during the product design and development stages. According to Bell (Giesen, Riddleberger, Christner & Bell, 2010), market research, combined with the emergence of new BMs in construction; for example, low or zero carbon buildings (Zhao et al., 2016), deepens understanding of users' needs and stimulates market research. Lastly, Wasiluk (2013) asserts that SBMs will improve policymaking for better governance and corporate sustainability strategies. This includes creating opportunities that impact positively on the HCI. Using BM elements as a foundation to bring sustainability in BM design, a conceptual framework using pictorial representation of BM elements will create necessary distinctions and organise ideas systematically.

3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	3.10
Introduction	Review of BMs in Business and Management literature	Review of BMs in Building and Construction literature	Summary of BM and development of SBMs Definition	SBM elements in Building and Construction	SBM for the Housing Construction industry	Relationships between the concepts	Boundary/Scope of the Study	Conceptual framework	Summary

3.7 Relationships between the concepts

Elements in a BM are the basic blocks used to layout value offering, creation, delivery and capturing mechanisms. This view alternates between short-term perspectives; i.e., revenue creation logic and long-term perspective, such as value proposition. Viewing the internal relationships between BM elements, it is safe to assume that every BM is dependent on one or more BM elements. However, some elements are crucial in terms of introduction of sustainability concepts. Creating space for adding sustainability in the value offering dimension is perhaps the most important challenge from the perspective of SBM transformation. Beside this framework, external factors, such as political, social and economic driving forces, create challenges to SBMs by presenting issues, such as limited demand, low financing solutions, imperfect markets and extreme weather events. External factors have overlapping relationships that affect the SBM and value creation channels. Thus, SBMs have interrelationships as defined by the flow of information between their elements.

3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	3.10
Introduction	Review of BMs in Business and Management literature	Review of BMs in Building and Construction literature	Summary of BM and development of SBMs Definition	SBM elements in Building and Construction	SBM for the Housing Construction industry	Relationships between the concepts	Boundary/Scope of the Study	Conceptual framework	Summary

3.8 Boundary/Scope of the Study

The SBM framework functions within one or more boundary variables, which ultimately decide the need for change in the ecosystem. The extent of boundary variables can significantly alter BMs and render them inconsistent with customer needs. For example, very low or high prices of land can result in negative profitability or low customer demand. In setting boundary variables, the extent and influence on SBMs is tricky and challenging. Researchers either adopt sustainability in an environmental context (Abuzeinab et al., 2016; Mokhlesian & Holmén, 2012; Zhao et al., 2016) or take a product-based view, which does not account for social and economic sustainability. Every internal and external activity, influence and boundary has a collective effect on sustainable value propositions. Sustainable activities may be unrelated or out of scope but exert influence on SBMs. The term 'sustainable value proposition' SVP refers to conducting business activities in compliance with a SBM design. This study is based on empirical data from top business and management executives, leaders and business partners in the Saudi Arabian HCI. The findings of this study will include the Saudi context and boundaries. However, findings from this study will create the basic tenet of a SBM, which can be replicated, with suitable adjustments and considerations, in similar habitats.

3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	3.10
Introduction	Review of BMs in Business and Management literature	Review of BMs in Building and Construction literature	Summary of BM and development of SBMs Definition	SBM elements in Building and Construction	SBM for the Housing Construction industry	Relationships between the concepts	Boundary/Scope of the Study	Conceptual framework	Summary

3.9 Conceptual framework

In order to boost the conventional BM and the transformation to SBMs, a conceptual framework is proposed, comprising five core components: i.e., a) identifying VP for each TC, b) confirming TC demand, c) establishing value creation by confirming KRs, VCs and PNs, d) establishing value capture by confirming CS and possible RM, e) establishing value delivery using the available DCs. According to Jonsson & Stiller (2016), a BM framework illustrates value creation through a renovation project in terms of customers and property owners. Determining customer demands is considered crucial when delivering value to residents. The building blocks of the conceptual SBMs framework are comprised of assessment of TC needs and their alignment with the technical requirements of a building, as detailed in Jonsson & Stiller (2016) and Zhao et al. (2016). However, integrating sustainability goals with customer objectives and demands leading to long-term value creation is a barrier that needs greater attention than this research, which considers the challenges facing the implementation of SBMs, has been able to provide. A framework, such as that used by Mokhlesian & Holmen (2012), for a green building, provides a valuable understanding of a BMs internal elements, information flow and exchange from value proposition to delivery and value capture, but does not combine the idea of sustainability in the BM itself.

Zhao et al. (2016) create a BM framework for delivering ZCBs as a combination of market viable sustainable product, resourcefulness of the organisation in sustainable technologies, and the underlying value proposition and delivery. Therefore, the framework combines the product with its target customer and estimates the financial costs, value configuration, capabilities and partner networks required to create an environmentally ZCB offering using its value networks and building processes. However, the framework entertains the idea of the possible challenges for each BM element and the benefits that influence ZCB delivery.

A SBM development from existing BMs requires reorganisation of its internal elements according to driving forces, such as customer demand and opportunities. A SBM framework will create, deliver and capture value in the following steps:

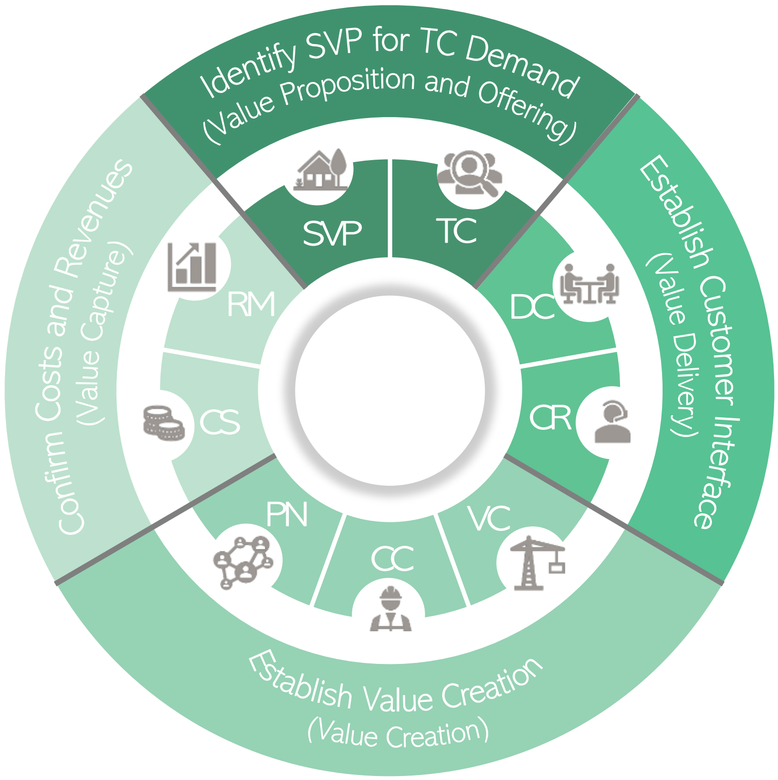

Fig 3-8: Conceptual SBM Framework for the HCCs

1) A sustainable value proposition is created hand-in-hand with its target customer to reduce risk and evaluate the market viability and demand for such value proposition. In this exchange, SVP and TC interact with internal and external sustainability issues, problems and challenges to create a sustainable value proposition that satisfies customer needs and upholds social, environmental and economic principles of sustainability.

2) Customer interface constitutes different channels that an organisation employs, or customers prefer, for engagement exchange of information, ideas and demands surrounding customer needs and expectations from residential housing. It highlights the relationships that a firm wants to maintain with its customers, depending on SBM requirements. Customer interfaces are responsible for developing revenue streams ensuring business sustainability.

3) The organisation starts value creation by identifying value configuration and capabilities enhanced by partner networks, and targets delivery of sustainable value propositions for each customer segment.

4) Firm-level infrastructure calculation and value creation processes feed the cost structures and revenue models, value delivery and capture from the target customers.

The HCC is responsible for evaluating its cost structures and sustainability in revenue streams for itself and its partners. The conceptual framework will be met also by study of external themes, such as changes, challenges and benefits of the implementation, that will optimise the transformation for the production of sustainable value propositions, ensuring value creation, delivery and captures in line. To present the development of the SBM, the figure (3-7) presents schematic detail of the transformation process.

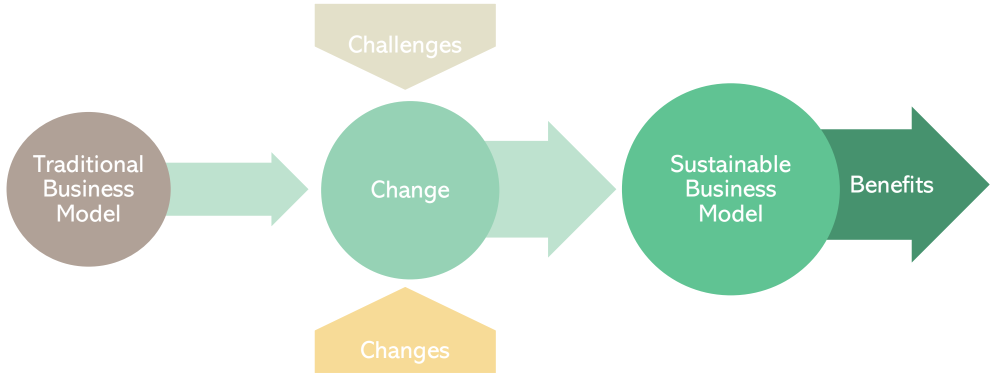

Fig 3-9: Schematic Overview of the SBM Development

Figure (3-9) shows that the research assumes that HCCs are using a traditional business model (TBM) and need to transform to a SBM to implant the SDGs driven from political, economic, social, technological, environmental and legal factors. During this transformation the TBM will indicate fundamental changes within the company, along with challenges to be addressed for the development of the SBM. Because of the limited literature available, a definition of the SBM must first be created, in addition to identification of the element needed for the transformation. Upon completion, it is believed that if the HCCs follow this systematic approach they will benefit from creation of an enhanced housing market.

3.1	**3.2**	**3.3**	**3.4**	**3.5**	**3.6**	**3.7**	**3.8**	**3.9**	**3.10**
Introduction	Review of BMs in Business and Management literature	Review of BMs in Building and Construction literature	Summary of BM and development of SBMs Definition	SBM elements in Building and Construction	SBM for the Housing Construction industry	Relationships between the concepts	Boundary/Scope of the Study	Conceptual framework	Summary

3.10 Summary

This chapter begins with a review of the BM approach to business management and its association with strategy. Literature relating to application of the BM in the HCI is also reviewed. The BM approach is at an early stage of development for use as a unit of analysis of value creation, delivery and capture mechanisms in the construction industry and more specifically in the HCI. The SBM for the HCI is at a unique intersection, encountering all the multidisciplinary problems faced by businesses and offering win-win solutions for multiple stakeholders hoping to achieve economic, social and environmental benefits. Components of the conceptual framework are presented in order to identify underlying building processes and activities critical in project delivery. The chapter concludes with an illustration of BMs with sustainable potential that can be supportive in development of robust models in the future. The next chapter discuses research methodology and justifies the implemented method, data collection and analysis techniques.

CHAPTER 4

Research Methodology and Strategies

Sections

4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9
Introduction	Research Models	Research Philosophy	Research Approach	Methodological Choice	Research Strategy	Time Horizon	Data Collection Methods	Summary

Chapter 4. Research Methodology and Strategies

4.1 Introduction

The research boundary, problems, aim and objectives were identified in the previous three chapters. This chapter presents and justifies the methods adopted to investigate the proposed framework and to validate the findings. The SBMs framework provides the basis for a preliminary investigation of the uptake of sustainability practices in the Saudi HCI. The framework will be useful for encouraging and guiding HCCs that are cooperating in sustainability implementation. This chapter will outline a variety of research models, approaches, strategies and data collection methods, with a particular focus on those that are most relevant to the research at hand. It will use this outline to justify decisions made in designing the research methodology, whilst illustrating strengths, weaknesses and practical considerations. The Research Onion model figure (4-3) has formed the basis for this research, as it directs the research with clear illustration for the process forming the research methodology and directs the implementation of the most suitable data collection methods. It also directs the readers through the methodology in a simple way, so that they can effectively achieve a good understanding of the methods adopted.

4.1	**4.2**	**4.3**	**4.4**	**4.5**	**4.6**	**4.7**	**4.8**	**4.9**
Introduction	Research Models	Research Philosophy	Research Approach	Methodological Choice	Research Strategy	Time Horizon	Data Collection Methods	Summary

4.2 Research Models

The Oxford Dictionary (2016) defines research as '*a systematic investigation into the study of materials and sources, in order to establish facts and reach new conclusions*.' While, research methodology can be defined as '*a way to systematically solve the research problem* (Kothari, 2004, p. 8). Likewise, O'Leary (2004) defines research methodology as '*a framework associated with a particular set of paradigmatic assumptions that are used by a researcher to conduct research*'. When designing the research methodology, two key considerations should be taken into account. Firstly, the methodology should be tailored to the research objectives, and secondly, that the methodology should be reproducible for other studies (Joyner, Rouse & Glatthorn, 2012). Therefore, the methodology is the chosen means of collating and analysing data, to provide answers to the questions '*why, what, from where, when and how* (Scotland, 2012).

A research model delineates a plan for approaching the research to be undertaken as well as a broad overview of the methodology, accounting for the decisions made as to how research questions will be addressed (Saunders, Lewis & Thornhill, 2016). The researcher must be able to account clearly for decisions made in the research design in terms of the research's purpose, aims and objectives, as well as justifications for technical approaches utilised in the data analysis. This section will review the research models' elements in order to justify the decisions made for this research project.

4.2.1 Crotty Research Model Elements

There are four key aspects of the research model defined by Crotty (1998). Figure (4-1) describes the research stages in the Crotty model. These four aspects are used to generate the four questions listed below, which a researcher should seek to answer.

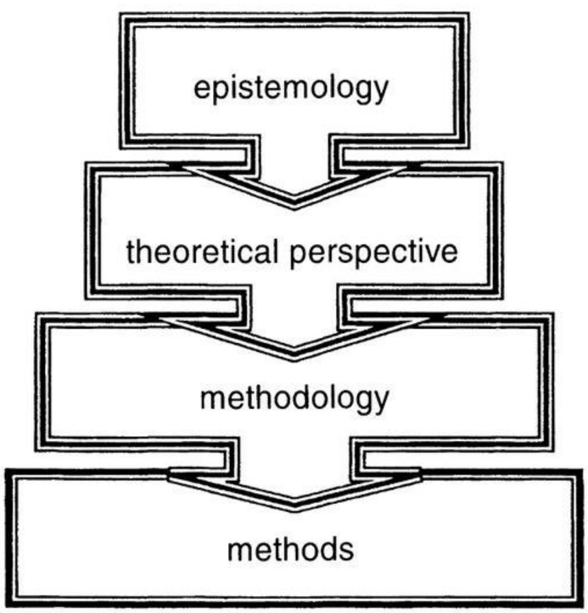

Fig 4-1: Crotty Research Model adopted from Crotty (1998, p. 4)

1) What mode of understanding is allowable and relevant to the study? ***(Epistemology)***

2) What are the philosophical ideas foundational to the methodology? ***(Theoretical Perspective)***

3) What underlying processes, plans, designs or strategies inform the use of specific methods? ***(Methodology)*** and;

4) How is the data collected and analysed? ***(Methods)***

4.2.2 Nested Research Model

Kagioglou, Cooper, Aouad & Sexton (2000) propose a nested model with three elements (see figure (4-2). The outermost layer is the research philosophy, which encompasses research approaches, which in turn encompass research techniques. In Kagioglou et al.'s model, the research approaches describe how theories are formed and tested, whereas the research techniques describe specific data collection methods. A research approach would be surveying or examining case studies, whereas a research technique would be a specific questionnaire or the process of making observations.

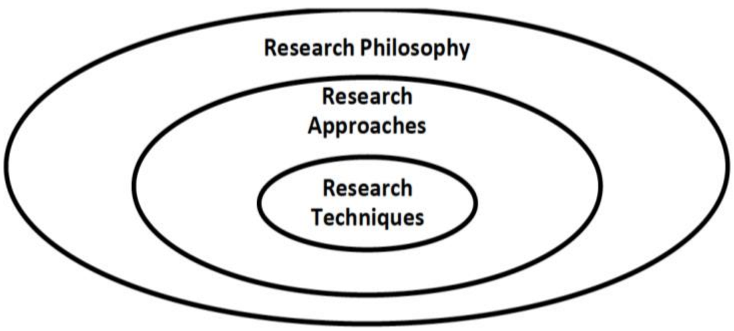

Fig 4-2: Nested Research Model adopted from Kagioglou, Cooper, Aouad & Sexton (2000, p. 131)

4.2.3 The Onion Model

The onion model has six sections (Saunders et al., 2016), which are nested similarly to the nesting model. These layers, from out layer to inner are: the research philosophy, approach, methodological choice, strategy, time horizon, and techniques & procedures (see figure 4-3).

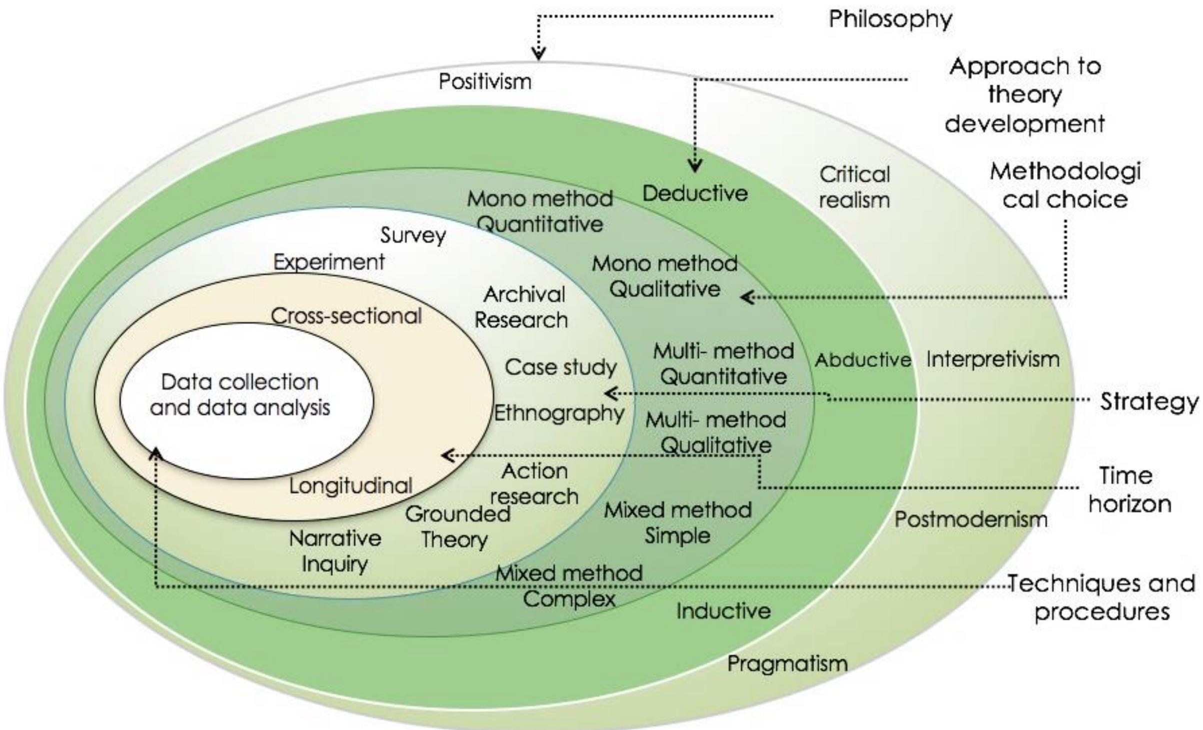

Fig 4-3: Onion Model adopted from Saunders, Lewis & Thornhill (2016)

Table (4-1) presents the differences between the three research models. Despite the degree of similarities, the Onion model, which stands out from the Nested model in the research approach, methodological choice and time horizon, argues that it should be selected before further research progresses and is selected as it helps the research to be more concise and cohesive. On the other hand, the onion model differs from the Crotty in terms of methodological choices and time horizon. The Crotty model has blended the choices and strategies ambiguously in one continuum. The Onion model highlights that the research can be conducted using combinations of techniques quantitatively and qualitatively (mono, multi and mixed methods). In addition, the onion model highlights the significance of selecting the 'time horizon' of the research study, either as cross-sectional or longitudinal.

Table 4-1 This model contrasts and compares the three model methods aforementioned (Sources: Crotty, 1998, Kagioglou et al., 2000, & Saunders et al., 2016)

Research Onion (Saunders et al., 2016)	**Nested Research Model** (Kagioglou et al., 2000)	**Crotty Research Model Elements** (Crotty, 1998)
Research Philosophy	Research Philosophy	Epistemology/Theoretical perspective
Research Approaches		Theoretical perspective
Methodological Choices		
Research Strategies	Research Approaches	Methodology
Time Horizons		
Techniques and procedures	Research Techniques	Methods

Based on the above arguments, this study utilises the Onion model for a variety of reasons. Primarily, compared with other research models, it provides greater detail of the steps to be undertaken in the research process. Subsequently, this finer level of detail allows the researcher higher explanatory power, with an opportunity to address each step and its variables when explaining a particular research model, thus providing development of a clear, logically ordered discussion of the research.

4.1	**4.2**	**4.3**	**4.4**	**4.5**	**4.6**	**4.7**	**4.8**	**4.9**
Introduction	Research Models	Research Philosophy	Research Approach	Methodological Choice	Research Strategy	Time Horizon	Data Collection Methods	Summary

4.3 Research Philosophy

The research philosophy is a broad term underpinning the researcher's approach to the formation and communication of knowledge (Saunders et al., 2016). The development of knowledge requires an open mind worldview to challenge existing paradigms and establish new facts in response to identified unknowns. Therefore, the research philosophy influences the way the researcher conceptualises reality (Johnson & Clark, 2006) and thus plays a role in determining the approach that a researcher takes towards data collection and analysis (Saunders et al., 2016). Dainty (2008) asserts that the research methodology not only discusses the methods in a research topic study but also comprises philosophical assumptions that support the research. Consequently, these assumptions impact the research methods used to investigate a particular issue during the collection and/or the analysis stage in which the research methods are applied to arrive at a solution and accomplish the objectives set out (Dainty, 2008).

Hence, the researcher's philosophy will affect the way the research is undertaken (Saunders et al., 2016). Therefore, it is essential to include an overview of the major positions in the research philosophy (Easterby-Smith, Thorpe & Jackson, 2015). There are three main arguments as to why further information on the research philosophies for this research is vital. As recommended by Easterby-Smith et al. (2015), the first argument is that understanding different research philosophies can aid in simplifying the research designs, including the different kinds of evidence gathered, the methods used and the way they will be interpreted. This leads to the second argument, which is that it will also offer insight as to which designs may or may not function in a particular situation. Finally, Understanding the research philosophies may offer guidance from outside the researcher's realm of experience (Easterby-Smith et al., 2015b; Gray, 2013).

Given its foundational role in research design, it is essential to render the researcher's philosophy visible so that it can be used to defend the decisions made in the process of developing new knowledge, primarily where methods with differing philosophies could have been used. Therefore, as mentioned previously, it is important to include an overview of the major positions in research philosophy. In the following section, the three major positions of **epistemology** (acceptable knowledge), **axiology** (value), and **ontology** (the nature of reality) will be described and considered, leading to an explanation and justification for the research philosophies undertaken in this research.

4.3.1 Ontology

Saunders et al. define ontology as the study of '*the nature of reality*'. There are two major ontological positions; Objectivism, which posits that '*social entities exist in reality external to social actors*', and subjectivism, which holds that '*social phenomena are created from the perceptions and consequent actions of social actors*' (Easterby-Smith et al., 2015;

Saunders et al., 2016, p.151). The subjectivist pole of this dichotomy is related to the idea of social constructionism (Scotland, 2012). Furthermore, Saunders et al. (2016) emphasise that '*it is necessary to explore the subjective meanings motivating the actions of social actors, in order for the researcher to be able to understand these actions*' (Saunders et al., 2016) with objectivity in mind. From a social constructionist perspective, objective reality is, therefore subjectively constructed.

Table 4-2: Comparison between Objectivism and Subjectivism adopted from Easterby-Smith & Thorpe (2008)

Ontology	Objectivism	Subjectivism
Truth	Single truth	There are many truths
Facts	Facts exist and can be revealed	Facts depend on the viewpoint of observer

This research aims to explore and construct SBMs for the HCI. The interaction between social factors in the market and the way managers translate these factors into practice is a substantial factor in determining the makeup of SBMs. Thus, the research must consider the motivations and views of social actors when exploring the way these models' function. Additionally, the research focusses on specific contexts looking for more in-depth information for the formation of the proposed framework. Therefore, this study will take a subjectivist viewpoint.

4.3.2 Epistemology

Epistemology is concerned with '*what constitutes acceptable knowledge in a field of study*' (Saunders et al., 2016, p.127). In dealing with the following questions: 'What is knowledge?' and 'What do people know?', this field of thought examines and establishes the nature of knowledge (Collis & Hussey, 2013). Epistemic thought seeks to answer questions about truth, the validity of knowledge, how knowledge is formed, and why it comes to be formed. What is believed, is compared with what is thought to be real, and both informal and formal methods of knowing reality are considered (Easterby-Smith et al., 2015).

There are four dominant philosophical positions that seek to systematically describe and prescribe the boundaries of knowledge. They are **positivism**, **realism, interpretivism**, **and**

pragmatism (Greener, 2008; Saunders et al., 2016). These will be elucidated in further detail, and an argument will be put forward as to which will be adopted for this study.

- **Positivism**

Positivism was developed as an approach to establish the laws of natural science. It prioritises concrete observable facts, and constructs strictly logical hypotheses only from what has been observed, as in physical and natural sciences (Easterby-Smith & Thorpe, 2008). When researchers apply positivism to social science, they view social existence as an observable set of facts, which can be studied in the same manner as nature. A positivistic approach seeks to deliver explanations for acknowledged and assessed issues, whereas an objectivist approach tends to assess theories and events. According to Easterby-Smith et al., 2015), the interpretations offered by a positivistic approach could help build connections and associate specific theories with them, while taking into account diverse variables. Additionally, positivism prefers the use of quantitative data to support an objective ontological position. As this research is related to subjective ontology, believing that reality is part of being observed, this approach is far be to apply.

- **Realism**

Realism avoids abstraction by positing that objects exist independently of the way they are subjectively experienced, constructing methods of investigating objects as such (Saunders et al., 2016). There are multiple approaches to realism, such as *direct* and *critical* realism. Direct realism takes cues from positivism to develop knowledge of phenomena from the direct sensory elements of experience (Saunders et al., 2016), whereas, critical realism was developed more recently in an attempt to marry concepts drawn from both positivism and interpretivism (which will be discussed below). A mixture of qualitative and quantitative data allows critical realists to avoid being bound by a rigid ontological stance.

- **Pragmatism**

A researcher who does not take on a formal stance and is, instead, more deeply interested in achieving results is, according to Saunders et al., (2016), a pragmatist. Moreover, the researcher will prioritise development of processes that enable research questions to be answered satisfactorily and will happily adopt stances that are conducive to the objectives from any school of epistemic thought rather than for their coherence or orthodoxy.

- **Interpretivism**

Interpretivism "*is directed at understanding phenomena from the individual's perspective, investigating interaction among individuals, as well as the historical and cultural contexts which people inhabit"* (Creswell, 2009; Scotland, 2012). This epistemology allows a researcher to introduce elements of reflection and intuition into the formation of knowledge, enabling investigation of *the subjective meanings motivating the actions of social actors* (Saunders et al., 2016), in sharp contrast with the objective, typically quantitative methods of positivism. This mode of investigation is, according to Saunders et al. (2016), ideal for interpreting the behaviour of organisations and individuals, and therefore ideal for application to business, management, marketing and human resource management research (Collis & Hussey, 2013).

Within the context of the research philosophy, this research aims to develop a framework for the application of SBMs in the Saudi HCI, and secondly, to provide a guideline for the implementation. As the process of producing such information involves several stakeholders from the HCI and the fact that their 'subjective' perceptions and attitudes collectively 'socially construct' what was seen as the sustainability as a phenomenon, the ontological stance of this research is placed on the subjectivism continuum. The different perceptions, experiences and attitudes of the stakeholders involved in the SBM process will be examined and analysed. Their interpretations of sustainability within the BM approach found in the HCI process will be varied according to the role, knowledge, capacity and level of experience of each stakeholder. Therefore, this study acknowledges the value of such differences in interpretation and will, therefore, utilise the in-depth interviews with several stakeholders and experts from the Saudi HCI to understand their different perceptions and form the basis of this study. Thus, the epistemological stance is taken in this study and placed in the interpretivism approach. In addition, the data collection process includes semi-structured interviews with various participants. The researcher considers that personal interaction with the participants is of high importance for the purpose of obtaining a suitable insight of the participants' perceptions and to understand the context of the study being discussed.

To further clarify between the most used paradigms in research; namely positivism and interpretivism, together with their features, see table (4-3) below for a comparison.

Table 4-3: A comparison of Positivism and Interpretivism adopted from Collis & Hussey, (2013)

Positivism tends to:	**Interpretivism tends to:**
Use large samples	Use small samples
Hypothesis testing	Generating theories
Objective, precise, quantitative data	Subjective, rich, qualitative data
Results with high reliability but low validity	Results with low reliability but high validity
Findings can be generalised from samples to populations	Findings can be generalised from one setting to other similar settings

4.3.3 Axiology

Alongside epistemology and ontology comes axiology. This is the part of philosophy that *'studies judgements about value'* (Saunders et al., 2016). Thus, it seeks to describe and systematise explanations of how things come to be known as good or bad (Heron, 1996; Sekaran, 2009). Self-reflection allows a researcher to make clear their own axiological positions, which then serve as a foundation for judgements made about the research undertaken, and the way in which the methodology for answering research questions and achieving research objectives is developed. This approach is related to the sub-division of reality, either value-free or value-laden (Collis & Hussey, 2013). In a value-free approach, the researcher's attitude is objective, independent of the subject being studied (Saunders et al., 2016), whilst a value-laden approach is related to humanitarian principles and knowledge (Easterby-Smith et al., 2015).

This study requires the researcher to become a part of the environment. One of the goals is to analyse the attitudinal settings, which could either disrupt or contribute to the success of the new framework. Many of these contributory factors are based on the social characteristics (behavioural) of the stakeholders within the HCI, who would apply the new framework. Therefore, the researcher allowed himself to become immersed in the environment, in order to gain direct subjective knowledge of current sustainability practices in the HCI, developing insight and empathy into how value is created and how SBM would establish an economic logic.

As this research takes on a subjective ontological lean towards an interpretivist epistemological perspective, it is impossible to coherently separate the researcher's value system from the object of the study. This is because communication and interviews with the stakeholders' SBM in the HCI are regarded as extremely significant when using the existing model, offering further subject knowledge and understanding. Consequently, the research is value-laden, adopting an axiological perspective, whilst dealing with subjective issues in order to fully understand the subject. As it is impossible to coherently separate the researcher's value system from the object of the study, there will be unavoidable interaction between the research value and its methodological choices. Figure (4-4) below depicts the complete research philosophy undertaken.

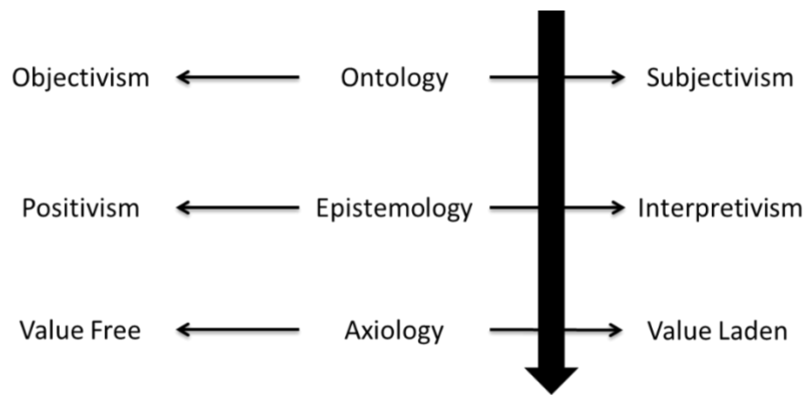

Fig 4-4: Summary of the Research Philosophy Used in this Research

4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9
Introduction	Research Models	Research Philosophy	Research Approach	Methodological Choice	Research Strategy	Time Horizon	Data Collection Methods	Summary

4.4 Research Approach

A research approach describes the series of choices that a researcher makes when taking theory and transforming it into actual research in order to make the research direction clear. In developing a research approach, the researcher must concretely form a research design, data collection strategies and methods, which will consider the reality of conducting research (Easterby-Smith & Thorpe, 2008). Notably, the selection of a coherent and practicable research approach is essential in achieving the research objectives (Patton, 2002). Saunders et al. (2016) & Yin (2014) assert that there are three major directions from which research can be approached, and it is vital that the researcher identifies the theory being applied to achieve consistent results.

4.4.1 Deductive

The deductive approach proceeds from theory to hypothesis, to collecting data, to reflecting on how the data confirms or denies the hypothesis and theory. Subsequently, the design of the research is then carried out and used to test the hypothesis, and will result in either confirmation, modification or invalidity (Gray, 2013; Thomas, 2006). The design of the research strategy is based on the literature reviewed and is used to test the theory. Consequently, this approach is linked to positivism as it revolves around the process of testing or approving a hypothesis (Saunders et al., 2016). Furthermore, Creswell (2009) believes that when a topic has enough literature to construct hypotheses and a theoretical framework, this leans towards a deductive approach, as it is centred around the development and testing of hypotheses.

4.4.2 Inductive

Inductive research, however, collects data prior to the development of a hypothesis and then produces a theory that accounts for the data as a result of analysis (Thomas, 2006; Yin, 2014). According to Hyde (2000), this approach is generally focussed on the circumstances in which events could occur. Moreover, Saunders et al. (2016) and Creswell (2009) argue that when there is insufficient literature available, then this approach could be more beneficial, as it is mainly concerned with the generation of new theory arising from the data collected. Whilst the deductive approach is compatible with positivism, the inductive approach lends itself to interpretivism (Saunders et al., 2016). Figure 4-5 highlights the main differences between the deductive and inductive approach.

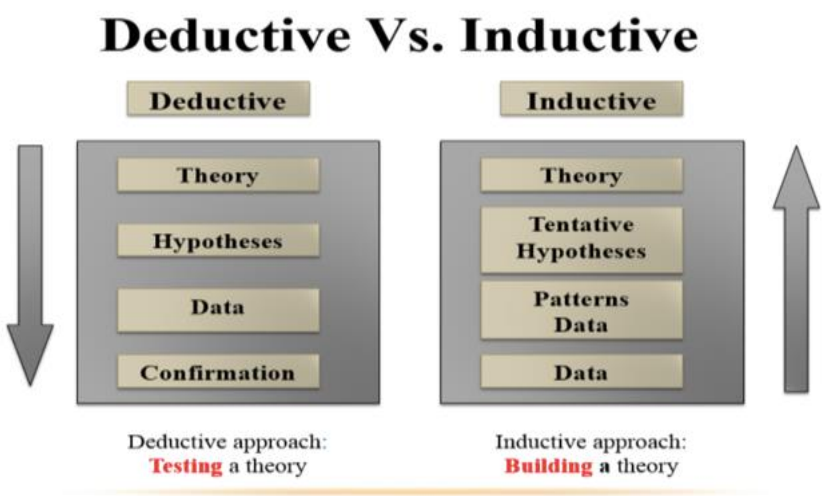

Fig 4-5: Differences between Deductive and Inductive Approaches adopted from Blackstone (2012)

4.4.3 Abductive

Another research approach related to theory is the abduction approach, sometimes referred to as abductive reasoning (Ketokivi & Mantere, 2010), with which it is possible to synthesise both the inductive and deductive research approaches. According to Saunders et al. (2016), an abductive approach originates from observation or exploration of a theme, perhaps the reasons behind a phenomenon or an adaption of current theory. This approach allows logical inference and is content to oscillate between data and theory in order to elucidate patterns that underpin a phenomenon (Alvesson & Skoldberg, 2010, & Saunders et al., 2016). However, there is no certainty of concluding and it is therefore different in this respect from the deductive approach. Table (4-4) illustrates the aims of the three different approaches, which are the deductive, inductive and abductive, from start to finish and offers a comparison between them.

Table 4-4: Research Approaches logics adopted from Blaikie (2010) & Saunders et al., (2016)

	Deductive	***Inductive***	***Abductive***
Aim	To test theories, to eliminate false ones and corroborate the survivor.	To establish descriptions of characteristics and patterns.	To describe and understand social life in terms of social actors' meanings and motives.
Start	From more general (generalisation) to more specific. Identify a regularity to be explained.	From specific and close understanding of the research context (accumulate observations or data) to a more general understanding.	Discover everyday lay concepts. Produce a technical account from lay accounts.
Finish	Test hypotheses by matching them with data explanation in that context.	Use these laws as patterns to further explain observations.	Develop a theory and elaborate it iteratively.

This research proposes a SBMs framework vision to realise sustainable creation, delivery and capture of values in the HCI context. The BM approach has been widely used in business and management practices, and this study has borrowed the idea to examine it in different areas and contexts where such an approach can be viewed as deductive. On the other hand, as this idea will be examined in a new context, the study will be more appropriate moving toward an inductive approach. Combining both approaches benefits the research topic as the sustainability of the BMs are a new research topic, especially in the HCI. Therefore, the abductive approach offers in-depth insights into the research topic and allows for the emergence of new knowledge. Nevertheless, this research uses the abduction approach, as it has the competence to go back and forth and be more comprehensive than the other approaches figure (4-6). According to Blaikie (2010), abductive approaches are usually associated with an interpretivism stance, which is aligned with this current study. Therefore, use of the abduction is employed, in combination with inductive and deductive approaches.

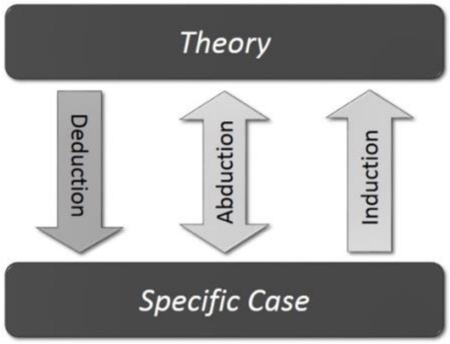

Fig 4-6: The abductive approach in research

4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9
Introduction	Research Models	Research Philosophy	Research Approach	Methodological Choice	Research Strategy	Time Horizon	Data Collection Methods	Summary

4.5 Methodological Choice

An important step is the identification of data collection methods and the way their analysis procedures are structured (Saunders et al., 2016). A 'mono-method' structure utilises a single data collection method, and a single set of analysis procedures to apply to the data unilaterally. While a multiple method structure selects multiple data collection methods and corresponding analysis procedures, it can mix qualitative and quantitative modes of analysis (figure 4-7).

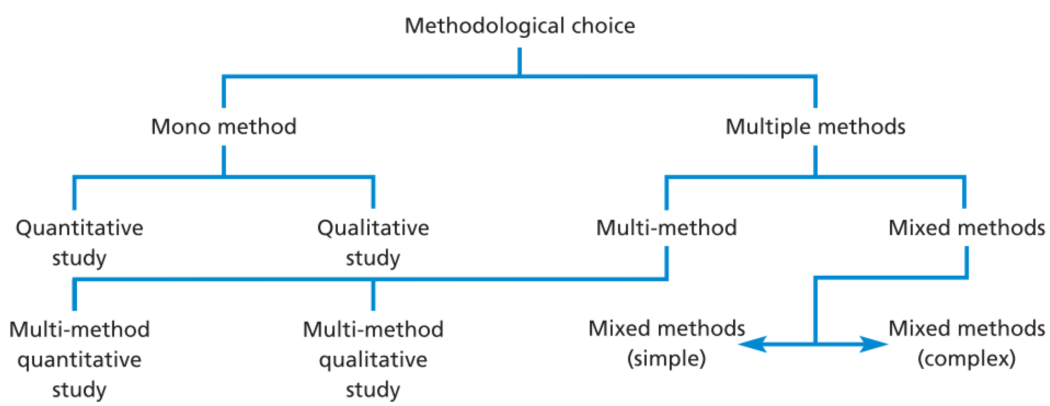

Fig 4-7: Methodological Choice adopted from Saunders et al. (2012)

4.5.1 Mono Method Design

The Mono-Method enables the researcher to collect and analyse either qualitative data by qualitative methods or quantitative data by quantitative methods (Tashakkori & Teddlie, 2003). Saunders et al. (2016) believe that there are two divisions in the mono methodological choice in that data is highly structured (quantitative), and data collected from the opinions of the actors (qualitative). Depending on the philosophical stance of the research and the research questions and objectives being investigated, the methodological choices can be quantitative or qualitative. The next subsections describe the mono methods design in more details.

- **Qualitative Research Design**

According to Amaratunga, Baldry, Sarshar & Newton (2002), qualitative research comprises identification of reality by focussing on the quality of information on the phenomena rather than static measurements. An important point to note is that in qualitative research there is no prejudice towards the subjects, otherwise this could result in inaccurate results. Jonker & Pennink (2010) emphasise that this type of research needs to involve 'a systematic search for the unknown'. There are various approaches to conducting qualitative research, including interviews, observations and focus groups (Amaratunga, Baldry, Sarshar & Newton, 2002).

The qualitative research design covers the objectives of this study comprehensively as it generates rich information from a small sample of participants. The flexible characteristic of the qualitative research and its ability to reveal complexity was relevant to this research since the subject of the investigation was complex in nature. The qualitative data gathered from qualitative research has often been defended as the best method for discovering and exploring a new research area (Amaratunga et al., 2002). These features are aligned with the nature of the current research. In addition, it is linked to an interpretivist philosophical assumption using semi-structured interviews and open questions (Jonker & Pennink, 2010).

- **Quantitative Research Design**

On the other hand, quantitative research lends itself to 'hard data' practices (Amaratunga et al., 2002). It is often linked to a deductive approach and tends to involve surveys asking 'who, what, where, how much and how many' questions, also known as 'closed' questions. The results tend to consist of considerable amounts of data, which help to explain different relationships and parameters (Saunders et al., 2016). The answers to these closed questions are based on existing theories and can be referred to as positivist assumptions (Jonker & Pennink, 2010).

4.5.2 Multiple Methods Design

This type of research is a mixture of both quantitative and qualitative methods used to understand in detail either a single case or multiple studies (Johnson, Onwuegbuzie & Turner, 2007; Teddlie & Yu, 2007). According to Saunders et al. (2016), there are two kinds of multiple methods; multi-method and mixed method, which are explained below. If researchers select this approach, they may then decide on a multi-method or mixed-method approach.

- **Mixed-Methods Approach**

Saunders et al. (2016) develop the idea of a mixed-methods approach, which may be described as either mixed-method research simple or mixed-model research complex. As it uses more than one method, this method helps in collecting much data on the research subject. Creswell (2009) suggests that it acts as a 'bridge' between both the quantitative and qualitative approaches, offering evidence and certainty of the findings, enabling researchers to incorporate the best aspects of research design (Creswell, 2014; Johnson & Onwuegbuzie, 2004). The mixed-model research complex will similarly utilise both qualitative and quantitative procedures for data collection, but will also consider qualitative and quantitative modes of thought in combination while undertaking other phases of the research. In general, when both data collection methods are used, along with their analysis techniques at either the same time (Parallel) or one after the other (sequential) (Creswell, 2014; Mertens, 2005), they can be determined together.

- **Multi-Method Approach**

A multi-method approach will combine several data collection and analysis techniques. However, these will be quantitative or qualitative, but never both. For example, multiple quantitative data, such as questionnaires and structured interviews, may be selected, and both may be subjected to statistical (quantitative) modes of analysis. This would produce a ‘multi-method quantitative study’. On the other hand, a researcher may choose to qualitatively collect in-depth interviews and discourse, and interpret these using qualitative procedures and structures, such as techniques of discourse analysis or, for a more extreme example, psychoanalytic readings (Creswell, 2014). This would produce a ‘multi-method qualitative study’. As such, a multi-method researcher will exclusively use either a quantitative or qualitative technique.

To explore SBMs capability of creating a sustainable value proposition and discover social, environmental and economic benefits, in-depth insight and flexibility are needed simultaneously. This research is focussed on identifying transformations in HCCs’ BMs when a sustainability agenda is implemented. As these transformations are regularly originated and planned in the HCI by senior stakeholders and decision-makers, an interpretivism position will be adopted when gathering the qualitative data using semi-structured interviews. From the above discussion, it can be seen that this research leans into the multi-methods design, and there are many reasons for choosing this approach. Firstly, based on the main aim of this research, which is to develop a SBM framework and provide a guideline for its implementation in the Saudi HCI, the multi-method approach is more appropriate as qualitative data will aid in developing an instrument for the second phase of the focus group as the purpose of the multi-method approach is to explore a phenomenon in depth. The information collected from purposive sampling during the qualitative stage will enrich the focus group’s findings and establish any significant relationships between the elements in the SBMs framework and the guideline. The characteristics of the focus group method involve group dynamics and identification of the perspectives of different participants; thus the type of data produced by this social communication will provide insight into the complex relationships between the elements of the SBM. The next section specifies important aspects in terms of research strategies and purpose of data collection and analysis.

4.6 Research Strategy

Saunders et al. (2016) suggest that a research strategy is a goal-oriented description of the research to be undertaken; a '*plan of action to achieve a goal … a plan of how a researcher will go about answering the research questions*' (Saunders, Lewis & Thornhill, 2016, p. 177). The manner in which these plans proceed is highly influenced by the research philosophies and approaches that underpin the research. The research purpose is, however, the critical aspect of the research, determining the goals of the research strategy and sketching a path towards them. Therefore, it is critical at this stage to identify the study purpose before discussing in detail the research strategy.

4.6.1 The Research Purpose

A typology of research purposes, developed by Lawrence (1997), identified three types of research: exploratory, descriptive and explanatory. Depending on the nature of the research, one or all may be used.

Descriptive research seeks to investigate the nature of phenomena and is used to collect data before exploratory research. It is often used in studies that seek to offer an accurate summary of a situation, person or event, and collects descriptive data, answering such questions as 'Who?', 'What?', 'Where?', 'When?' or 'How?'. Descriptive purposing can be an extension of exploratory research, part of exploratory research, or an originator of explanatory research.

Exploratory research aims to collect data regarding 'What' and 'How'; defining and gathering data on the phenomenon being studied. It is the favoured method for discovering new phenomena and gaining insights. Yin (1994) supports use of this method when the research inquiry is relatively contemporary, or when there is little information and literature available on the phenomena.

Explanatory research aims to analyse the phenomena being studied to establish the relationships between variables. Questions to be asked during the data collection phase to gain an explanatory response include 'Why' or 'How'.

Combined research has more than one purpose in its strategy. To achieve this, the methodological choice may include multi-methods (section 4.5.2) to facilitate exploratory, descriptive and explanatory purposes.

- **Justification for the Combined Research Purpose**

The study at hand is primarily exploratory research, which also hopes to provide tentative explanatory outcomes in a combined model. Saunders et al. (2016) argue that adopting both exploratory and explanatory methods enables a researcher to pursue answers to how, what and why questions. This research reflects on the question '*how can housing construction companies successfully make fundamental changes to their BM(s) based on sustainable value propositions, thereby improving or sustaining economic performance?*' in both its research design and in the selection of its sources of data.

While the main aim of this research is to explore and explain SBM concepts in the context of the HCI, it also aims to understand relevant sustainability practice in business experiences and the choices behind a BM, including views on how the fundamental changes of a company's BM (business model) occur as a result of sustainable value propositions. Moreover, an exploratory research design is preferable as the interview data collected will be instrumental in the development of a tool for the following phase, which is to explore a phenomenon in-depth with the focus groups. Furthermore, the data gathered from the purposive sampling during the qualitative stage will enrich discussion in the focus groups findings.

Secondly, as the study crosses disciplinary and there are no instruments available to assist in carrying out the research, the combined design will aid in the development of a set of instruments for the final phase. One of the main objectives is to gather detailed information from experts in the field during the qualitative phase and use this data to design a tool suitable for the final phase to authenticate the framework outcomes.

Thirdly, as the research study is complex, the combined design is beneficial for achieving in-depth understanding of the BM structure, as well as establishing the context and factors influencing that structure, based on comprehensive information obtained from interviewees.

4.6.2 Alternative Research Strategies

The research strategy is categorised into eight distinct types; experiment, survey, case study, ethnographic, action research, narrative research and grounded theory (Grey, 2004; Robson 2002; Saunders et al., 2016). In relation to the positivist and interpretivist epistemic approaches, it is possible to sort research strategies into two different groups, deductive and inductive. However, some research issues require methods that do not fall into either of these categories, and some may combine both positivistic and interpretive approaches (Saunders et al., 2016; Creswell *et al*., 2003; Robson, 1993).

All the research strategies provide for the collection and analysis of empirical data, and each strategy has systemic strengths and weaknesses. Moreover, some researchers allude to a hierarchical relationship between the strategies, depending on the purpose of the research. For example, surveys capture accurate profiles of people, situations or events; case study works well for exploratory work, such as investigating situations and gaining insights, while the experimental approach works best when seeking explanations for problems or situations that manifest through casual relationships. However, Yin (2014) stresses that strategies do not show a logical partition between possible forms of enquiry; thus, when choosing the appropriate research strategy, factors like timeframe, research question, and a focus on contemporary events should be considered see table (4.5).

Table 4-5: Selection criteria for different research strategies adopted from Yin (2014)

Strategy	***Form of Research Question***	***Requires Control of Behavioural Events?***	***Focusses on Contemporary Events?***
Experiment	How, Why?	Yes	Yes
Survey	Who, what, where, how many, how much?	No	Yes
Archival Analysis	Who, what, where, how many, how much?	No	Yes/No
History Case	How, why?	No	No
Case Study	How, why?	No	Yes

Consequentially, researchers in the business modelling arena, such as Pekuri et al. (2013; Sommer, 2012; Wong et al. (2010), recommend interviews when conducting BM research, including all parties' stakeholders insights, such as government, developers, consultants, contractors, suppliers and academics, as such insights may have interactive and/or independent effects. Therefore, the methods used in this research will evoke stakeholders from all around the HCI independently. For the aim of this research, the term 'stakeholders' includes seniors (Director/General Manager or equivalent) from the government, developers, consultants, contractors, suppliers and academics. On this occasion, the study requires the research strategy to include all the information and insight necessary to analyse the opinions and on-going perspectives of a broad cross-section of participants: government, developers, consultants, contractors, suppliers and academics in the context of the HCI. Additionally, the strategy requires the researcher to understand varying perspectives across divergent groups. Lastly, this strategy facilitates construction of the stakeholders' perspectives, providing a holistic overview.

Because this research seeks to answer 'what', 'how' and 'who' questions, the need to control behavioural events is unnecessary, and the survey model was adopted somewhat tentatively. However, surveys, when used as a research strategy, fall into the positivist, objectivist and deductive epistemic framework, giving a focussed analysis of a point in time and rely upon empirical data to achieve the objectives (Denscombe, 2007). When adopted as a strategy, the survey incorporates and facilitates use of other research methods. In this context, the survey reveals the plan of a chosen population via observation of a sample group from within this population. The survey's application is limited; while it is well suited to observation of the characteristics of the individual members involved, it is not a useful tool for observing interaction between individual persons, institutions or their environments (Groves et al., 2004). Moreover, the survey covers quantitative studies that articulate distributed numerical nuances in a population (Denscombe, 2007).

However, a qualitative approach to investigating and defining variation in populations also exists. Wester (2000) and Jansen (2010) consider the qualitative survey as a way of applying grounded theory alongside theoretical sampling and continual comparison. Such application involves several empirical cycles, including the iteration of analysis and data collection intended to study a population's diversity as opposed to its distribution. The qualitative survey does not seek to establish frequencies, means or other parameters, but instead establishes the diversity and in-depth overviews of a given topic within a population (Jansen, 2010). Although it is worth noting that while many have proposed different classes of qualitative research, no author has specified the qualitative survey as a genuine category of research, with only Wester (1995, 2000) using this approach to distinguish the qualitative survey as a primary type of qualitative research alongside ethnography and case study, 'hence its logic as a research strategy is still confusing and almost non-existent in textbooks or general social research methodology' (Wester ,1995, 2000). Therefore, Jansen (2010) puts forward the argument that researchers often mislabel qualitative surveying as grounded theory or unspecified qualitative research, both of which have received criticism for their weak methodological justifications. Jansen (2010) postulates categorisation of the qualitative survey as its own type of qualitative research within Creswell's (1998) model. As shown in figure (4-8), Creswell proposes five distinct types of qualitative research, each representing an established practice in the social sciences; these are, biography, phenomenology, grounded theory, ethnography and case study.

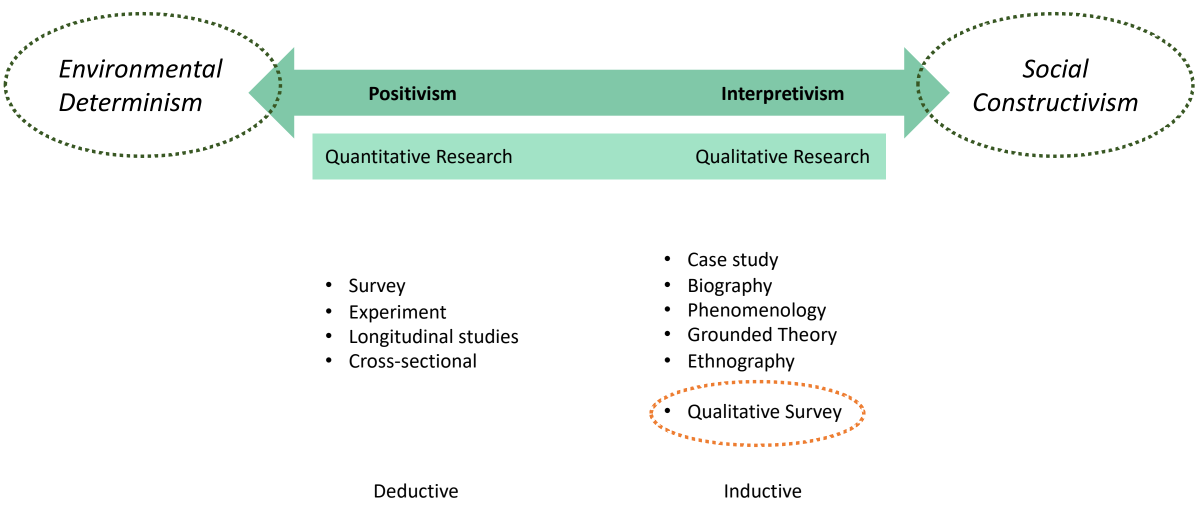

Fig 4-8: The Qualitative Survey position as a category in the qualitative research strategies with references proposed by Creswell, adopted from Jansen, 2010 and Creswell, (1998)

In light of Jansen's proposed positioning of the qualitative survey as an established qualitative research practice, this research utilises the qualitative survey as its primary research strategy, for the reasons listed below: a) the qualitative survey facilitates ‘exploring’ the diverse nature of ‘certain behaviours or cognitions within a given population’; b) ‘exploring’ occurs through comparing analysed and ‘categorised’ data collected from a numerically specified cross-section of that population; c) the different categories are justifiable with quotes from the research participants (Jansen, 2010).

Therefore, using the qualitative survey as the primary means of research enables the author of this research to: a) gain an understanding of the full depth and breadth of the required data, and to interpret insights gained from analysis of such data; b) assimilate and acknowledge the diverse range of views and unique perspectives of the research participants; c) lend a voice to participants whose voices may otherwise have gone unheard.

In this research, the strategies for collecting qualitative data; i.e., ethnography, case study, action research and grounded theory, have been excluded for the following reasons:

Action research entails investigation of practical concerns within specific groups. The strategy aims at offering solutions for problematic situations within acceptable ethical frameworks (Saunders et al., 2016). The strategy has become common in psychology, nursing and education, where the professionals seek to solve contextual problems. As such, the strategy appears inappropriate for this research, focussing more on real situations, rather than on contrived, explorative studies.

Ethnography, unlike qualitative surveys, involves the search for patterns of interaction in a specific community. Ethnographers do not search for diversity among individual members of a given community (Jansen, 2010). This strategy cannot be applied to this study as the researcher is outside this context and it is, therefore, considered inapplicable.

Case study strategy usually refers to cases as organisations or institutions rather than populations and requires in-depth analysis of individual cases or a small sub-set of cases, with multiple data sources and repeating observations (Creswell, 1998; Yin, 2003). The case study, like action research, was considered initially for this research and later rejected for reasons relating to accessibility and availability. It was considered unlikely that participants would be comfortable providing information about income, revenue, employment, etc. in a setting that involved others.

The sophisticated, yet lengthy and intensive grounded theory is a model intended to generate explanatory theories and therefore requires multi-source iteration alongside multisite data collection and analysis (Charmaz, 2007). Moreover, this research does not include grounded theory because this research is not concerned with the study of social structures and processes but is, instead, formulated to study diversity in a population. Additionally, for practical reasons such as resources and time constraints, the author did not consider the grounded theory to be a viable research strategy.

4.6.3 Definition and the use of Qualitative Survey Strategy

The qualitative survey strategy articulated by Jansen (2010) is ‘the study of diversity (not distribution) in a population’. A qualitative research strategy differs from the statistical survey strategy in that the latter seeks to estimate or evaluate the frequency of characteristics in units within a population. Jansen (2010) defines the qualitative survey as ‘all studies of diversity in a population without restrictions as to the number of empirical cycles or the way of generating codes: data-driven, prior-research-driven or theory-driven.’

Like other strategies, the qualitative survey has distinct phases and steps, the first of which involves specifying the central research questions that the study seeks to address and aims to achieve ‘a sense of specificity and focus’ (Gray, 2004). Sampling is the second step, data collection the third, with analysis as the fourth and final step. Jansen’s (2010) qualitative comparison survey, table (4-7), utilises this four-step approach and both qualitative and statistical surveys can originate from identical aims and even from identical research questions; however, the first difference occurs at the second stage: sampling, which is discussed in section 4.8.4. The second difference occurs during phase four: analysis, addressed in section 4.8.6.

Table 4-6: Differences between qualitative and statistical survey adopted from Jansen (2010)

Steps	***Qualitative Survey***	***Statistical Survey***
1. Defining knowledge aims		
Topic (material object)	any topic	any topic
Aspect (formal object)	Diversity	frequency distribution
Empirical domain	any population (collection)	any population (collection)
Unit of data collection	members of population	members of population
Knowledge function	primarily description	primarily description
2. Sampling		
Method of selection	diversity; by purpose	probability; by chance
Criterion for size (N)	saturation	precision of estimate (CI)
3. Data collection		
Measurement level	any	any
Method of collection	any	any
4. Analysis	diversity analysis	distribution analysis
1st-level analysis Unidimensional description	coding data (downward and upward) in objects, dimensions and categories	counting frequencies descriptive statistics estimating parameters
2nd-level analysis Multidimensional description	*case-oriented:* combinatory synthesis of diversity: property-space analysis, typology construction *concept-oriented:* holistic synthesis	*Unit-oriented:* cluster analysis, homogeneity analysis *variable-oriented:* correlation, factor-analysis, index construction, scaling
3rd-level analysis explanation	deterministic explanation: combinatory analysis QCA, pattern analysis	probabilistic explanation: discriminative analysis, regression, LISREL

4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9
Introduction	Research Models	Research Philosophy	Research Approach	Methodological Choice	Research Strategy	Time Horizon	Data Collection Methods	Summary

4.7 Time Horizon

Research time horizons have been classified as either cross-sectional or longitudinal (Saunders et al., 2016). Cross-sectional research investigates occurrences of a phenomenon simultaneously, while longitudinal research considers how a phenomenon changes and develops over time (Sekaran & Bougie, 2016). This research will focus on providing insights into SBM characteristics for the housing construction organisations and identifying how they can be achieved. This research will not consider the practical changes of a phenomenon over time and, owing to time constraints, a longitudinal time horizon has been eliminated. Therefore, the present study is deemed to be cross-sectional.

4.1	**4.2**	**4.3**	**4.4**	**4.5**	**4.6**	**4.7**	**4.8**	**4.9**
Introduction	Research Designs	Research Philosophy	Research Approach	Methodological Choice	Research Strategy	Time Horizon	Data Collection Methods	Summary

4.8 Data Collection Methods

'Data' is the recorded information on the topic being studied. In this context, data consists of texts relating to different methods, such as literature reviews, previous researches, interviews and focus group transcriptions, plus similar types of material made available for analysis (Richards, 2009). The methods used for data collection are the specified procedures for gathering data. Jansen (2010) states that both qualitative and statistical surveys collect data by carefully questioning people, and is the most common type of survey, although researchers can also collect data by observing 'interactions' or 'artefacts' in any situation.

However, Jansen (2010) claims that in Qualitative Surveys, methods or types of data collection are not limited by the research strategy but by the qualitative approach. Primarily, the correct choice of method should include the participant's perspectives alongside the researcher's reflections as an integral part of the process (Flick, 2002).

Because the questions posed to the research participants at a data collection level needed to gather data that would go on to form the research questions (Maxwell, 2005), the objectives of this research informed the qualitative survey questions. The literature review from chapters two and three of this research guided the interviews and focus group questions, and was, in turn, derived from synthesis of the SBM elements, challenges, changes and benefits of the implementations in the HCI. Further information about the participants is presented in section (5.3.1).

Participant responses can be collected in a variety of ways. Standard qualitative methods include in-depth interviews, observations and focus groups (Hancock, 2006), whereas, common quantitative methods include questionnaires, structured observation, and structured interviews (Gill, Stewart, Treasure & Chadwick, 2008). Multiple and mixed-method approaches are often used to collect trustworthy data, despite differences in the collection, analysis, and interpretation procedures related to each method (Harris & Brown, 2010). The present study will take on the combination of literature review, interviews and focus groups when collecting data from study participants. These data collection techniques will be explained and examined, including definitions and comprehensive justification for their selection, as well as legitimate concerns about trustworthiness and credibility of the results. Their sampling techniques and procedures for analysis will then be examined.

4.8.1 The Interviews

Qualitative research interviews seek to draw key themes from direct conversation with subjects. The priority is developing an understanding of discourse that is true and meaningful, produced by participants (Kvale, 1996). Interviews draw information from a participant's experience, which can assist interviewers in gaining a narrative account of a phenomenon (McNamara, 2009). There are three types of interview: structured interviews, unstructured interviews and semi-structured interviews (Gray, 2013 & Saunders et al., 2016), all suitable for differing scenarios.

- **Structured Interviews**

Structured interviews consist of predetermined questions, delivered by an interviewer in a consistent order. A set of predetermined answers is also provided for each question, from which the interviewee must select (Easterby-Smith et al., 2015; Saunders et al., 2016). Interviewers may then choose to clarify some questions if required. They are regularly used in surveys (Saunders et al., 2016).

- **Unstructured Interviews**

Unstructured interviews allow an interviewer to engage with respondents informally and spontaneously, providing no formal restrictions on what an interviewer may say. The interviewer is likely to begin with open-ended questions relating to the topic of interest and may probe respondents to clarify or reflect upon their responses, as well as spontaneously follow avenues of enquiry they suggest themselves (Easterby-Smith et al., 2015; Saunders et al., 2016). This style of interview is suited to explore relatively unknown topics, as well as collecting narratives (Saunders et al., 2016).

- **Semi-structured**

Semi-structured interviews are neither completely open nor rigidly constrained. Interviewers may collect data in a structured way, for example by theme, or can ask predetermined questions with the ability to probe for further information and collect responses in the participant's own words. This style of interview is suited to systematically collecting in-depth information from a significant sample size or range of respondents (Saunders et al., 2016 & Seidman, 2013).

- **Justification for Using Semi-Structured Interviews**

For the purpose of this research, semi-structured interviews have been selected as the research approach for the following reasons:

    - Semi-structured interviews are useful for understanding a context and finding out what is happening in an exploratory study, or to discover the reasons behind the positions of participants (Saunders et al., 2016).

- They enable the researcher to build a relationship of trust with the interviewees; hence, encouraging truthful responses that will improve the validity of the research findings (Gray, 2013; Saunders et al., 2016).
- They are the most suitable approach for complex or open-ended questions; hence, they can be used in an exploratory or combined study that seeks new insights (Saunders et al., 2016).

From this discussion, it becomes apparent that semi-structured interviews are the most suitable for the study at hand because they afford the researcher a degree of freedom to examine the phenomenon’s themes and attain two primary goals: exploring and recording the interviewees’ perceptions of a given subject, and comparing the information and insights with other participants’ views (whether hypothetical or established) (Newton, 2010). Moreover, semi-structured interviews are further suited to this research as they facilitate two-way communication, enabling new avenues of questioning to steer interviews in unexpected directions, considered beneficial to this research, as well as assuming a conversational approach. This conversational criterion has been selected because of the novel nature of SBMs in the context of the HCI, and therefore insight from experts with a practical working knowledge of the context is of high value. The interview format produces information on social and organisational realities by soliciting data directly from knowledgeable participants. This research has used predetermined interview questions, presented in a standard order, covering the main areas of interest. With these interviews seeking to elaborate the existing BMs and project changes as adapting or incorporate sustainable business practices, to deliver sustainable projects in light of future challenges. The interviews vary in duration because the author wished to extract valuable participant insights rather than pursuing a methodological constancy; therefore, adhering to a set-timeframe for each interview was of little importance. The practical and theoretical implications of the data collected from interviews will be discussed later in chapter 5 (for raw data collected during interviews see Appendix (5).

4.8.2 Focus Group

Paul Lazarsfeld and Robert Merton from Columbia University were accountable for originating ‘Focus Groups’ in the 1940s (Bloor et al., 2001). Initially, these focus groups were used for research in business and marketing but has since branched out to encompass many fields (Easterby-Smith et al., 2015; Silverman, 2013). Research using focus groups is said to be ‘loosely structured, guided conversations among a group of individuals’ (Easterby-Smith et al., 2015). Put simply, therefore, the structure is that of a group interview where each individual is free to express opinions or perspectives.

Silverman (2013) and Easterby-Smith et al. (2015) believe that focus groups can be used as (1) an isolated approach to acquiring qualitative data; (2) a tool that can be used to explain further conceptual issues that may arise in subsequent interviews. Keeping these views in mind, it is appropriate to choose this method for researching and addressing areas of concern communication that have arisen through this conceptual framework. It also provided qualitative data that was rich and informative for helping build and progress the conceptual framework.

Focus groups, whilst maintaining their structure, should allow participants to express their perspectives without hesitation, yet leave room for new ideas to emerge (Stokes and Bergin, 2006). A topic guide is used to help define topics in a broader sense and helps the focus group moderator when explaining it to participants (Easterby-Smith et al., 2015). The following characteristics were identified in the focus groups selected:

- The experts were working or supervising in a Saudi HCC.
- The experts were positioned at the top levels of management, such as a board of directors, presidents and vice-presidents, and Chief Executive Officers (CEOs). Their roles varied from controlling and overseeing the entire organisation, to setting up strategic growth and development plans. Therefore, including them in the expert panel group was appropriate as their experience in the industry and knowledge about issues surrounding housing construction and sustainable practices was considered likely to be of value.
- The expert member group had more than 10 years’ experience, which implied that they had a better understanding of problems, issues, challenges and opportunities in the field of construction, and more specifically in the HCI.

The participants were encouraged by the moderator, from the beginning, to focus on the SBMs framework for the HCI. Later, the moderator merely encouraged interaction between participants rather than engaging with them on an individual basis.

The steps relating to noting, gathering, and writing the data retrieved from the groups and for creating the framework were completed using interpretive structure modelling (ISM). The ISM is a well-known procedure used to create connections between various aspects and to explain a research's challenges. ISM also consists of steps to help with specifying the location of the complicated connections between these aspects (Sage, 1977). Sample of the focus group questions for the development of the SBMs framework and the validation phase can be seen in Appendices 16 and 17.

Before the focus group day, the participant had the questions in their email. This step helped in the discussion as the participants came with a clear idea about the research and questions needed to be answered. On the day of the focus group, the initial PowerPoint Presentation (PPP) for the framework was discussed with regards to the conceptual framework. Each phase of the framework required participants to think individually and then jointly about key activities. This helped bring to light problems participants may have faced but which had not been covered or discussed in the literature.

The second PPP of the framework was discussed regarding the final framework for the validation. The participants were asked to discuss theoretical items alongside missing content, which they may not yet have encountered. PPP was open to alteration and amendment by the participants. This helped to analyse the participants' real-world encounters when considered in parallel with the authenticity of theoretical frameworks.

The data that was collected and participants were told that their sessions would be audio recorded. Consent was first obtained from all participants. After the event, consent was again obtained from each individual in private. The lead researcher, along with three colleagues, discussed their observations relating to the second workshop.

4.8.3 Research Sampling Techniques

For sampling, in a statistical survey context, the researcher needs to know the probability sample; i.e., the probability of selection for any chosen member of a population. Therefore, a sample framework consisting of a full population register is needed to estimate and determine a sample size. Adversely, the very nature of the qualitative survey makes it better suited to the process of 'discovery' rather than the testing of a hypothesis; therefore, the approach to sampling differs. Lincoln and Guba (1985) describe this qualitative approach as 'emergent and sequential'. The selection of people, texts or events in the scope of the research follows a 'path of discovery' through which a sample group emerges sequentially as a result of decisions made in earlier research stages. It is ultimately the job of the researcher to pursue the investigation, 'until the questions have been answered and things can be explained' (Denscombe, 2007).

Other differences between statistical and qualitative surveys relating to time, size, composition and representativeness are listed below:

- In qualitative surveys, the process as a whole can provide excitement, but it can also be frustrating, as it is usually time-consuming in a way that conventional 'snapshot' surveys are not (Denscombe, 2007).
- The sample size and composition are not as predictable in qualitative survey research as in statistical surveys. An estimate of how many people, texts or events, or more specifically, which people, texts or events, coupled with time and resources available, and 'some reading of similar studies' in the planning stages of the research project 'must remain exactly that – an estimate'. However, qualitative research primarily deals with relatively small-scale research, frequently involving between 30 and 250 cases (Denscombe, 2007).
- In terms of representativeness, the cross-section will aim to include unique stances, for reasons of being extreme or unusual, or instances of being best or worst. Identifying unique stances leads qualitative researchers to choose non-probability sampling techniques; i.e., 'purposive sampling', 'snowballing' and 'theoretical sampling'. In a non-probability sample, participants are deliberately selected for specific characteristics – not because the participant is believed to be relevant to the

study, but because they are selected using intuition instead of scientific reasoning. Therefore, they cannot be relied on to accurately reflect the general population (Backstrom et al., 1981). An infographic showing the sampling process within the Qualitative Survey derived from Denscombe's model (2007) is shown in figure (4-9) below.

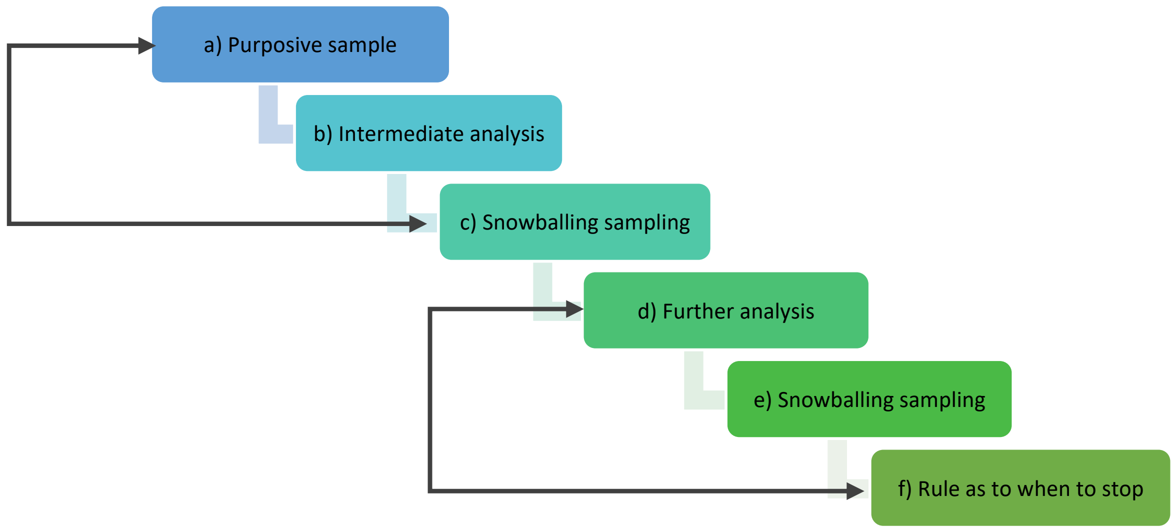

Fig 4-9: The Sampling Process in the Qualitative Survey Graphic derived from Denscombe (2007)

Throughout this research, sampling, as per Denscombe (2007) and Lincoln and Guba (1985), has taken the path of sequential discovery. Using sequential discovery took a considerable amount of time. The author considered a combination of 'purposive' and 'snowballing' sampling techniques to gain a diverse representation of selected participants.

Purposive sampling works by deliberately selecting specific people (or events) with a specific purpose of reflecting that individual's particular qualities and relevance to the topic of investigation (Denscombe, 2007). In the snowball sampling method, the sample group manifests itself through referrals from one participant to the next. The researchers then contact these nominees who (hopefully) agree to be part of the sample group. This way, the sample snowballs in size as each nominee is, in turn, asked to nominate other participants (Denscombe, 2007).

Therefore, to obtain a relevant representative sample of the contemporary HCI in Saudi Arabia, the researcher selected those in high-level job positions and experts from the HCI – for example, from the certified HCCs in the Ministry of Housing (MOH) – who had demonstrated prior experience in the housing construction sector through construction projects, qualifications, and relevant responsibilities. The MOH database shows that there are 71 certified companies in the country. They are classified based on their organisational capability, organisational structures, institutional capability, financial capability, and a record of their achievements and experiences (MOH, 2014). See figure (4-10) below for more details.

Fig 4-10: Criteria for the Qualified HCC in the MOH adopted from MOH (2014)

Size and Technique – The sampling goal is to purposively select an adequately representative sample. For this sample, the participants were selected based on their being heavily involved in the housing construction industry, as proven through their employment at relevant companies, as well as being willing to provide interviews. Potential participants can be selected based on their suitability for providing the information required to achieve research objectives (Renukappa, Egbu, Akintoye, & Goulding, 2012). Interviewees were selected according to the following criteria:

- Senior/management level role in the housing construction industry

- Relevant experience in sustainability strategies and practices
- Relevant experience in business development and strategic plans
- In a position with the power to make decisions about sustainability and construction initiatives
- (If possible) a sustainability manager, expert, or officer

These participants will then provide feedback on the SBM elements, reflect on the terminology used, discuss the relationship and importance of the elements, and report on the BM changes when involved in sustainable practices and initiatives. The obtained qualitative data will be in the form of BM process and requirements, challenges, benefits, and changes in the BM when including sustainability. As a result, the interview sample size depends on the level of consensus (Guest, Bunce & Johnson, 2006).

Table (4-7) below shows the minimum size of non-random sampling suggested by Saunders et al. (2016) when carrying out semi-structured interviews. Along the same lines, Guest et al. (2006) confirm that a sufficient number of participants in an interview should reach a saturation point of 12 persons, with this number fundamental in achieving enriched information. However, this depends on the complexity of the subject matter, so in this research, a total of 22 participants in the high positions will be consulted.

Table 4-7: Minimum Size of Non-Random Sample adopted from Cresswell (1998)

Method of study	***Minimum sample size***
Semi-structured/in-depth interviews	5-25

4.8.4 Research Ethics

The researcher should ensure the credibility of the research. Therefore, this research will consider the following based on ensuring credibility. For each stage of the research design phases, the participants will be introduced to the study and the goal of each stage. In term of the interviews, participants will receive a ‘Letter of Invitation’, which encompasses a summary about the researcher, his topic and an invitation paragraph (see Appendix 1). If they accept the invitation, they will be given a 'Consent Form' to be signed by the participant (Appendix 2). Then an information sheet will be sent to them explaining the research scope to ensure that all participants understand that participation in the study is voluntary and that their consent will be secured prior to interviews (see Appendix 3). Throughout the study, the participants will be ensured that they can withdraw at any time without needing to give any reason. If they withdraw from the study, all the information and data collected will be destroyed and the name removed from all the study files (see Appendix 4 for the Ethical Approval Letter).

4.8.5 Data Analysis Procedures

As mentioned earlier when discussing the sampling technique for this research, when employing a qualitative approach, data collection and analysis are not explicitly separate but coincide (Maxwell, 2005). Both processes can be described as transactional and cyclical because one sheds light on the other causing a chain reaction of subsequent collections, analyses and interpretations. For example, analysis comes after the first round of data collection, the insights gained from the analysis are then used to determine which data should be collected next; the cycle repeats itself until theoretical saturation, or an explanation for the phenomenon is obtained (Jansen, 2010, Robson, 2002).

Qualitative researchers choose to approach data analysis not just by the type of data they collect or their initial research questions, but by the epistemic approach underpinning the study.

In any of the following three possible approaches used by researchers, analysing and interpreting data using the previously mentioned qualitative approach is considered to be a 'reflexive' part of the research process, and enjoys a symbiotic relationship with the data collection stage (Miles and Huberman, 1994).

The analysis of qualitative data typically requires a reductive process to select, distil and simplify the data, rendering it into a readily manageable state (Miles and Huberman, 1994). Richards (2009) observes three phases of data reduction:

- The first phase of the data simplification process is to decide what data to record and what to omit
- The second phase is to decide what data will be fully transcribed, just summarised or left untranscribed
- The third phase of the analysis, as an understanding and the data develop, and researchers gain confidence in their understanding, the decision is made regarding which data to keep and which data to discard, either because it is off-topic or not relevant.

By following this process, the researcher progresses from the initial data collection stages through to the analysis and later, interpretational stages, in what is both an iterative and transactional manner. This process, and the subsequent mode of operation, involves developing the categories used to classify the initial data before pursuing subsequent data collection, analysis and interpretation, until the categories become saturated (Jansen, 2010). Maxwell (2005) states that qualitative analysis strategies fall into three main groups which can 'and should be combined' and used alongside categorising strategies, such as coding and thematic analysis; connective strategies, such as the analysis of narratives or individual case studies; and memos and displays to help the researcher make sense of the data.

- **Interviews' Qualitative Data Analysis Procedures**

Data analysis is vital to any research, as it describes how a researcher goes about arriving at justifiable conclusions from the data. This research has applied thematic analysis to the interview data in order to determine key themes and topics of interest as they arose (Braun & Clarke, 2006). There are six sequential stages of data analysis that allow a researcher to achieve a high-quality analysis of qualitative data. This method allows researchers to derive useful, digestible conclusions from specific sections of the data (Braun & Clarke, 2006; Guest et al., 2006). These six stages are laid out in figure (4-11) below.

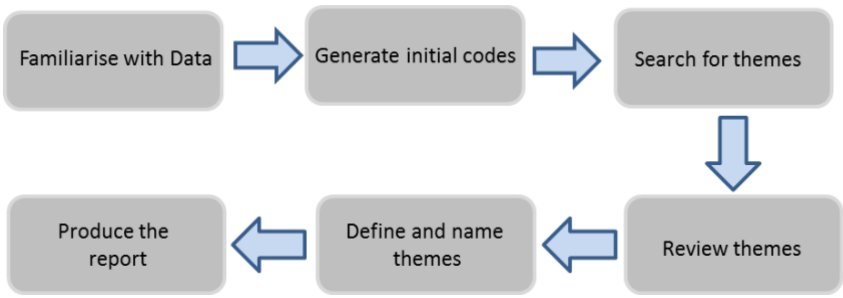

Fig 4-11: Stages of Thematic Analysis adopted from Braun & Clarke (2006)

- **Content and Thematic Analysis**

According to Saunders et al. (2016), when an exploratory approach is used, content analysis can help to examine the qualitative information gathered and answer the research question. This can be done by producing transcripts for each semi-structured interview (Saunders et al., 2016). Specific features, such as word count, can then be examined. Another form of analysis is thematic, which identifies themes and patterns that can be organised and coded into a more detailed data set ready for examination (Easterby-Smith et al., 2015). According to Creswell (2009), the main categories that form the semi-structured interviews can be effective when identifying themes, along with sub-themes that can also be further developed.

The process of data analysis in this study starts first with transcribing and translating the interviews (Appendix 5), overviewing the data and listening to the records, and reading the transcripts many times to ensure accuracy. This stage ends with a short summery of the initial data and codes gathered from the site. The second step begins with analysis of the questions and gathering data related to each question, including date relating to another question but gathered under the same question to ensure consistency. Thirdly, according to Kibert (2007), to remove ambiguity when conducting sustainable construction research, it is better to use predetermined themes. Accordingly, the answers collected form the themes to be examined. The main themes in this study include a) SBM perceptions and definitions; b) SBM elements; c) changes associated with SBMs; d) SBMs associated benefits; e) and SBM challenges. The main themes prepared and introduced on what the sub-themes are about in order to accomplish the fourth step requirements. As an example, SBMs challenges theme indicated to six sub-themes are relevant. The nods inside the sub-themes names and interpretation emerged purely from the interaction with the gathered data. Lastly, the study presented the outcomes with discussion the existing body of knowledge where links were recognised.

- **Qualitative Analysis with NVivo**

Software packages such as CAQDAS, ATLAS, MAXQDA, and NVIVO are designed to streamline qualitative research. For the purpose of this research, NVIVO software has been selected to assist with the coding and categorisation of data analysis procedures, as well as to organise the data and improve accessibility (Welsh, 2002). NVIVO software and training is provided to the students of the university free of charge. The software facilitates data manipulation, browsing, coding, annotation, and access to specific records through a user-friendly interface (Azeem & Salfi, 2012). Further benefits that can be obtained through the use of NVIVO software (Hoover & Koerber, 2011) include:

1. Efficiency: Utilising software is substantially less labour intensive than manual, paper-based data management or non-specialised processors such as Word and Excel.

2. Flexibility: NVIVO allows multiple forms of data storage and conversion between data types, which can be efficiently coded and transformed into nodes.

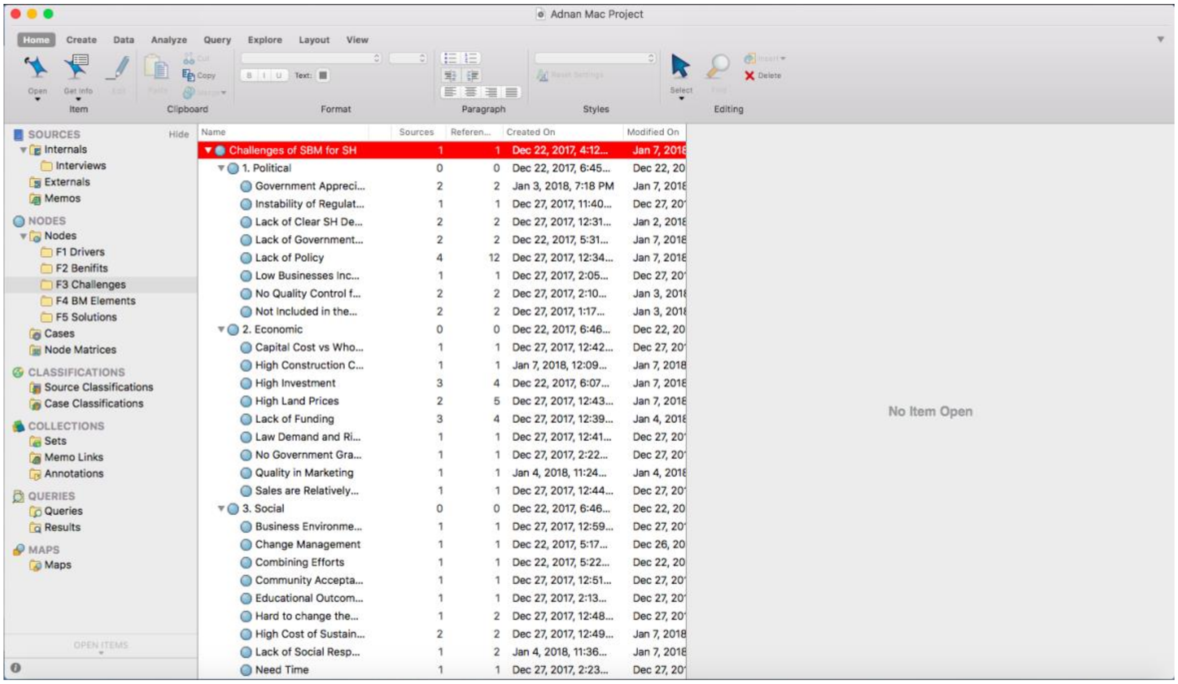

Fig 4-12: NVivo software interface after categorising the data.

- **Focus Group' Data Analysis Procedures (Interpretive structural modelling ISM)**

Warfield (1974), the founder of Interpretive Structural Modelling (ISM), introduced this approach as a method to address and understand complex issues. The underlying premise of the ISM technique is to guide experts in developing relationships between multiple factors. The nature of the extent of these relationships, as Warfield noted, range from simple to complex relations (Ansari, Kharb, Luthra, Shimmi & Chatterji, 2013). The ISM approach is thus to create a set of linear associations by placing different courses of actions together with the objective of solving the target problem (Sohani & Sohani, 2013). An example of this method to solve complex problems is found in the aerospace industry, such as NASA (Meena & Thakkar, 2014). Three languages are used in this type of modelling, which involves a combination of words, diagraphs and discrete mathematics. These constructs combine to form a methodology that can help in structuring a complex issue. The ISM technique has been widely acknowledged and used by researchers to represent relationships diagrammatically and show the interrelations among the various elements targeting a unique set of problems. The systems within which these problems arise are easier to understand using the ISM methodological approach. However, in recent years, significant research contributions have been found that indicate a growing interest among researchers to employ ISM in the area of sustainable practices in the construction industry. Six core areas seem to have also gained popularity, such as supply chain management (SCM), business and marketing, town and city planning, technological innovations, lean project management, and public health management. Further descriptions of this can be found in table (6-1) below:

Table 4-8: Papers published in the construction industry during the last four years related to use of the ISM model in sustainability practices

Topic	Purpose of using the ISM	Reference	Journal Name
Supply Chain	to identify the relationships between lean and sustainable supply chain practices and their impact on the three different dimensions of sustainability	(Ruiz-Benitez, López, & Real, 2019)	Renewable and Sustainable Energy Reviews
	to identify the driving and dependence powers in sustainable supply chain management within the context of knowledge management	(Lim, Tseng, Tan, & Bui, 2017)	Journal of cleaner production
	to establish the mutual relationships among the drivers of critical success factors of the sustainable supply chain	(Raut, Narkhede, & Gardas, 2017)	Renewable and Sustainable Energy Reviews

Business / marketing/accounting	to help in building guidance on the conceptual design of sustainable product-service systems	(C. W. Chen, 2018)	Sustainability (Switzerland
	to analyse the interaction among innovation capability factors	(Kiron & Kannan, 2018)	International Journal of Business Innovation and Research
	to understand the collective impact of barriers to green business modelling	(Abuzeinab et al., 2017)	Journal of Cleaner Production
	to draw interrelationship and framework for the varied elements that show the linkage between environmental accounting and industrial growth in the built environment	(Singh, Panackal, & Sharma, 2016)	International Journal of Applied Engineering Research
Planning Cities and Society	to determine hierarchical relationships among the seventeen sustainable development goals (SDGs)	(P. Kumar, Ahmed, Singh, & Sinha, 2018)	Environment, Development and Sustainability
	to classify sustainable construction practice factors in China for planning an implementation plan	(Yu, Shi, Zuo, & Chen, 2018)	Sustainable Cities and Society
	to explore the interrelationship amongst various barriers to sustainable neighbourhood development and developing a hierarchical structural model	(Shi et al., 2017)	Journal of Cleaner Production
	to determine the interrelationships among the criteria of most suitable photovoltaic solar plant location	(Lee, Kang, & Liou, 2017)	Sustainability (Switzerland)
Technological Capabilities	to establish a hierarchical structure, and matrix impacts cross-reference across factors of BIM Adoption in Chinese Construction Organisations	(Ma, Jia, Ding, Shang, & Jiang, 2019)	
	to understand the hierarchal and contextual relationship structure among the barriers of e-waste management	(A. Kumar & Dixit, 2018)	Sustainable Production and Consumption
	to evaluate influential relations between technological capabilities	(Rajesh, 2017)	Technological Forecasting and Social Change
Lean Management	to interpret the relationship of drivers and challenges of the adoption of lean management in Industrialised Building System	(Noor, Yunus, Abdullah, Nagapan, & Mazlan, 2018)	International Journal of Engineering and Technology
	To establish the contextual relationship among lean practices and then ranking the performance measures	(Chaple, Narkhede, Akarte, & Raut, 2018)	Benchmarking: An International Journal Interpretive
	to draw the relationship between the fifteen barriers of green lean implementation	(Cherrafi, Elfezazi, Garza-Reyes, Benhida, & Mokhlis, 2017)	Production Planning & Control, The Management of Operations
	to analyse the key barriers to lean implementation in the construction industry and draw a hierarchy and contextual relationship of the barriers	(Khaba & Bhar, 2017)	Journal of Modelling in Management

Risk/ Public Health Management	assesses the interrelationships between hazards/risks barriers for effective implementation of Occupational Health and Safety	(Y. Li, Sankaranarayanan, Thresh Kumar, & Diabat, 2019)	Annals of Operations Research
	to analyse the uncertainties and risks in the design phase of the construction projects	(Etemadinia & Tavakolan, 2018)	International Journal of Construction Management
	employed to ascertain the interrelations among Critical Success Factors for Safety Management in Subway Construction	(Liu, Li, Bian, Song, & Xiahou, 2018)	International Journal of Environmental Research and Public Health
	To construct an aggregated network of the interrelated risk factors in Construction Projects	(Tavakolan & Etemadinia, 2017)	Journal of Construction Engineering and Management

Interpretive structural modelling engages the learner in an interactive exchange by combining interrelated elements into a comprehensive model. Therefore, ISM can be regarded as a modelling method for analysing a set of elements, each of which contributes in some form towards the model under examination. In a similar vein, the tool is relevant in the context of identifying and imposing relationships among elements that combine to form a closed system (Warfield, 1974). Thus, ISM can be regarded as a well-known and purposeful methodology to recognise relationships among specific items and understand these relationships to uncover the core issue (Sage, 1977). According to ISM methodology, application of graph theory is used to conceptualise the workings of a systematic application and combine the theoretical and computational aspects to explain the complex patterns in matching relationships among a set of elements (Malone, 1975). Thus, the ISM process leads to the transformation of ambiguous and poorly articulated models into a visible and well-defined model through a structured approach for further review and scrutiny. The benefits and drawbacks of this approach are described below:

According to Attri et al. (2013), the advantages of using ISM methodology are as follows:

- It is interpretive due to the experience of group members dictating the relationship among elements within the constructs of the model.
- There is a defined structure set according to the nature of mutual dependencies among elements while leading to the extraction of an overall structure from those complex relationships.

- As the representation is largely according to a digraph model, it is regarded as a modelling technique.
- It can impose order and direction according to the relationships among elements in the system.
- It is viewed as a group learning process with some benefits to individual learners.

However, there are some limitations to the ISM methodology, which are as follows:

- The modelling technique is useful for participants with prior knowledge of the topic that is studied and having undergone specific learning modules to understand the nature of the ISM methodology. This enables experts to become well-versed in interpreting the data.
- The technique requires extensive use of computers, which is difficult in studies or researchers with limited resources or computer facilities.
- The links generated can be subject to multiple interpretations by the user, which is a drawback of the model.
- The relationships generated before and after the modelling process are dependent on the person's knowledge and experience as well as the bias that extends from the designers self-understanding of the subject, a judgement of the variables and familiarity with concepts (Kannan & Haq, 2007).

Therefore, removing the restrictions and limitations extended to the model requires validation of the purpose at different intervals and integrating the ISM methodology. The ISM model has been conducted in two phases. The first one finishes by presenting the final model with all consistence outcomes. The second phase is the validation where the participants validate and agree final outcomes see figure (4-13). The steps in the ISM approach are presented below:

Step 1: The SBM elements are identified within the HCI and listed**,**

Step 2: Contextual relationships are established between the elements of the SBM identified in step 1,

Step 3: A matrix is created called the Structural Self-Interaction Matrix (SSIM) for the SBM are noted,

Step 4: A reachability matrix is created with the help of the SSIM and is checked for transitivity. In terms of the contextual relations, the elements extend to other elements. This forms the underlying premise of the ISM technique, which is that if ‘X’ extends a given relation to ‘Y’ and ‘Y’ extends the same relation to ‘Z’ then through inference ‘X’ extends the same given relation to ‘Z’,

Step 5: The reachability matrix created in step 4 is divided into multiple levels,

Step 6: A directed graph is drawn that examines the relationships between elements based on the input values of the reachability matrix while removing the transitive links in the process,

Step 7: The final digraph is converted into the ISM model by replacement of the element nodes with some statements,

Step 8: The ISM model created in the previous step is iteratively reviewed to check for inconsistent information, links or relationship statements and to make the necessary modifications. By the end of this phase, the first FG mission is completed, and the next set is for validation,

Step 9: The model is found to be valid when there are no autonomous elements in a disconnected state in the system. Thus, the driver-dependence diagram should not have any loose elements without causal relationships. A similar approach has been taken with PESTEL challenges to implementation of the SBM. This is shown in figure (4-13) below:

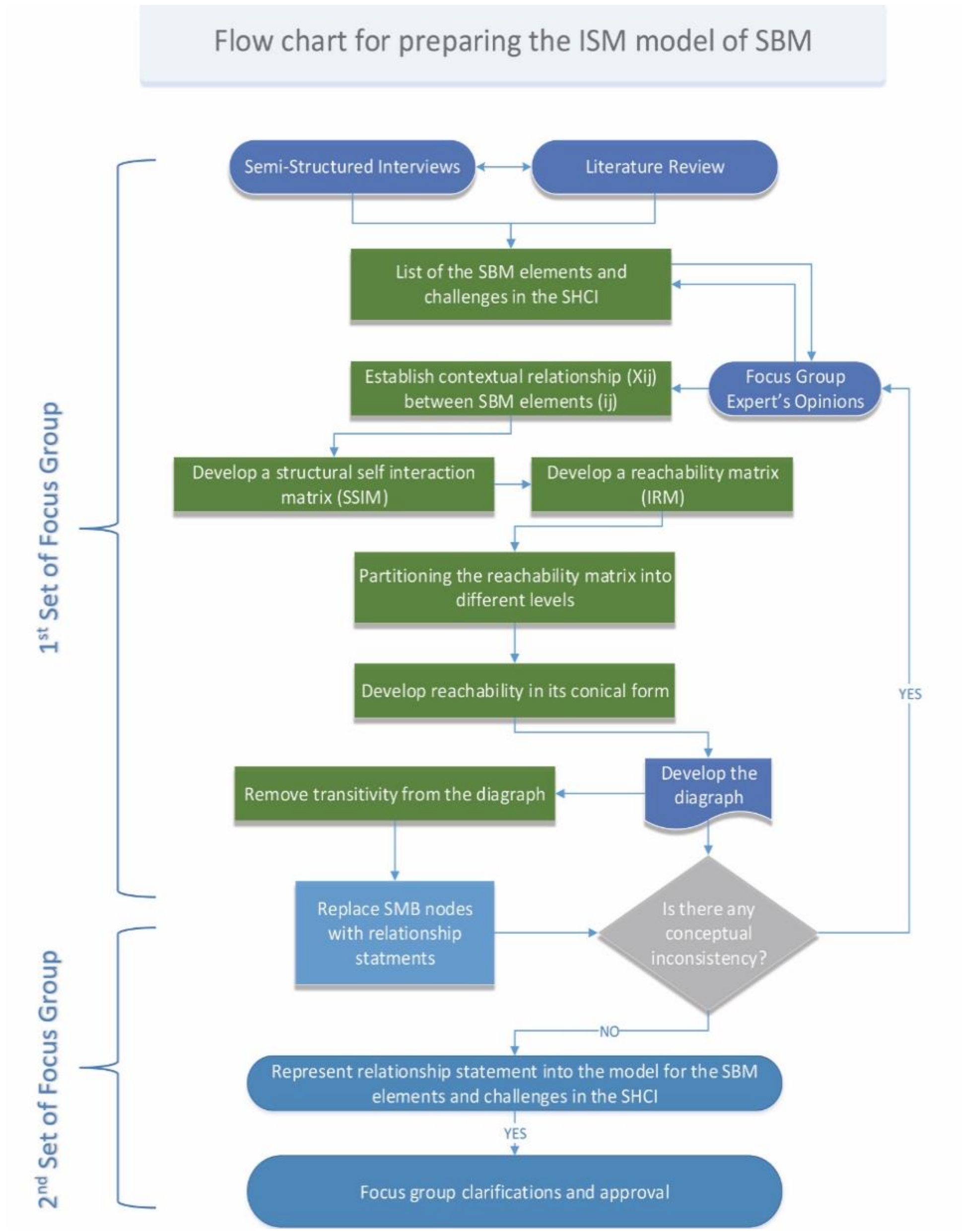

Fig 4-13: Flow chart for the preparation of the ISM model for the SBM modified from Kannan 2009)

In summary, the ISM methodology provides an integrated approach to understand complex issues. As the nature of a given problem in the real-world environment could be difficult to understand due to the interplay of multiple elements, the ISM methodology can provide a clear view for researchers to interpret the data according to information obtained from primary research. The information is generated through the knowledge of experts in the industry and researcher's own bias is removed through this modelling method. Even simple issues present in modern society may have a complex set of elements that are interrelated with each other. Thus, ISM methodology can present a structure to draw these elements and define the relationships among them to give a clear view, based on inputs from experts in the associated industry, such as housing construction.

4.8.6 Trustworthiness and Rigorousness (validity and reliability)

For some time, researchers working in qualitative research have debated notions of validity and reliability with some suggesting that while such terms may be appropriate in the field of qualitative research, the preference is for terms like ‘trustworthiness’, ‘rigorousness’, or ‘quality’ of the data (Kelle and Laurie, 1995). It is still imperative that researchers conduct qualitative research and analysis of data in a manner that is both thorough and transparent (Creswell, 1998; Lincoln & Guba, 1985; Miles & Huberman, 1994).

Establishing the trustworthiness of interview findings is important and, as such, measures have been taken to encourage trustworthy responses. A pilot phase was undertaken prior to conducting the bulk of the interviews. Five participants received the full set of questions, with observations made about the scope of the interviewee’s response, and the questions considered for length, clarity, and relevance. Before the final set of questions was decided upon, the pilot interviews also provided a chance to identify leading questions and subsequent researcher bias. Some questions were rewritten based on observations made during pilot interviews (Gillham, 2000). Interviews were around 2 hours each. A tape recorder and written notes were used to record the respondents’ responses. The possibilities of data loss or tampering (unintentional or otherwise) have been mitigated by collecting information in both hard and soft form (Gill et al., 2008).

Several measures were taken to ensure maximum credibility and data quality, as recommended by Hewson (2003). These measures include briefing interviewees on some aspects of the interviews prior to conducting them, including purpose, duration, consent and topics of interest, as well as making suitable appointments for conducting the interviews. The researcher followed recommendations made by Easterby-Smith et al. (2008) aimed at avoiding interviewer bias, which included thematised interview schedules to avoid leading questions, and ensuring that interviewees found interviewers credible. A copy of these themes was provided to the interviewees before the interviews to assist them in preparing for the interview. Probing questions were avoided, as well as overly long or jargonistic questions.

Following the suggestions of Robson (2002), the manner in which the interview was conducted was taken into account. Suitable appointments were made, interview durations were kept reasonable, and the interviewer ensured personal presentation, posture and attitude were conducive to ideal interview conditions. Only summary notes were taken during the interview in order to retain focus, and these notes were reviewed with the interviewee at the conclusion of the interview, as recommended by Ghauri and Grønhaug (2010).

Combined with comparisons between interviews collected by this research from interviewees involved in the HCI, as per Yin's (2014) suggestion, it was hoped that these steps would increase the credibility and reliably of data collected during interviews. Contextual information was appended to the interviewer's notes, such as the time of the interview, information about the interviewee, location, and the interviewer's impressions to further increase the interviews' credibility, as suggested by Guba & Lincoln (2001).

Guba and Lincoln's (2001) framework for measuring conformability and transferability was also applied. Interview results were peer-reviewed and discussed with the participants, allowing the introduction of expert interpretations and considerations of evidence other than the researcher's own. The data's transferability to the HCI context was also considered.

In dealing with validity, this research followed strategies that, according to Maxwell (2005), increase credibility of the conclusions; e.g., 'triangulation', the use of 'rich' data, and the use of specialist computer software. In regards to triangulation, this refers to the utilisation of multiple methods to develop the knowledge of a single phenomenon (Saunders et al., 2016). As per table (4-8) below, triangulation methods can be divided into four categories (Denzin, 1973).

The use of triangulation is encouraged to diversify approaches to a phenomenon and thereby address a problem that no single method can reliably accomplish alone (Paton 2002), as each method, properly applied, provides clarity on a different aspect of reality, without a clear hierarchy of methods (Walker, 2005).

Table 4-9: Types of Triangulation and Occurrence adopted from Denzin (1973)

Types of Triangulation	**Occur when:**
Data Triangulation	Data is collected in different contexts and settings at different times.
Investigator/research Triangulation	More than one researcher investigates and may have different knowledge and experience in the same situation.
Theory Triangulation	Several different or competing theories are used whilst examining data.
Methodological Triangulation	Involves the use of multiple methods of data collection, analysis within or across the issues in an attempt to decrease the weakness and biases of each method and increase validity by reducing the weakness of one method with the strength of the other method. For example, it involves the use of multiple qualitative and/or quantitative methods to study SBM implementation in housing construction.

The present study makes use of two of Denzin's (1970) triangulation methods; data and methodological triangulation. Data triangulation is found to be appropriate for analysing data sourced from contrasting contexts, such as the HCCs, and other stakeholders from the HCI, whilst methodological triangulation has been utilised to draw inferences from data collected using different techniques of interviews and focus groups.

Methodological triangulation serves multiple purposes (Saunders et al., 2016), including facilitation, and evidence triangulation. Facilitation refers to the synergy between data collection methods, where one method aids another. In the present research, interviews have been guided by the development of the questions coming from the literature review, as the exploratory information gathered from the interviews can be used to clarify the interests of the questions developed for the focus groups.

Moreover, triangulation involves corroborating data from multiple collection methods to improve the trustworthiness of research findings (Saunders et al. 2016). This study has triangulated the interview and focus groups findings to strengthen the data and therefore enhance the trustworthiness of conclusions drawn from it (Proverbs & Gameson, 2008).

As the present study utilises a multi-method design, it draws on a large body of scholarship with regards to the order in which data collection techniques are conducted, and how triangulation can be applied (Caracelli & Greene, 1997; Creswell, 2009; Mertens, 2005; Tashakkori & Teddlie, 2003). There is consensus among these authors that there are two major approaches to triangulation: parallel and sequential. A parallel approach utilises multiple data collection techniques independently of other data collection techniques, with the results then being triangulated. A sequential approach uses one or more data collection techniques to inform and aid the collection of data by other techniques.

The sequential phase does not allow for independent data collection, as the outcomes of one collection method will affect the collection of data by other methods. As this study uses interviews to inform the development of questions for the focus groups, it can be classified as a multi-method design in sequential form. The finding data from focus groups is thus dependent on the qualitative data collected from interviews.

Regarding generalisability, that which Polit and Hungler (1991) defined as 'the degree to which the findings can be generalised from the study sample to the entire population' (Polit and Hungler, 1991), qualitative researchers often study in only a single location or a small number of individual sites, often using theoretical or purposeful sampling instead of probability sampling, rarely making explicit claims of how generalisable their accounts are. Notably, Maxwell (2005) states that the value of a qualitative study is dependent upon its lack of generalisability in terms of being representative of the broader population, but it may still result in a useful account of a setting or population that is still illuminating either as an extreme case or as an 'ideal type' (Maxwell, 2005).

Adversely, Maxwell (2005) also recognises that qualitative research is generalisable or 'transferable' via a different set of logical principles than that of a sample survey. Yin (2003) describes this as 'analytic generalisation' and 'statistical generalisation', respectively. The analytic generalisation is not a generalisation of a defined population that the researcher has sampled, but of a theory of the phenomenon the researcher is studying, a theory that might have much broader applications than the particular sample studied. Therefore, for this research one can argue that regardless of the sample size (22 participants), the sample was never intended to make statistical generalisations to a larger population but rather, as Yin (1994) explains, it was intended to make analytical generalisation a means to expand theory, as the author believes the results of this study are grounds for more in-depth understanding that, in turn, can inform theory and practice, and it may also be possible to replicate these findings in other similar or larger studies.

4.1	**4.2**	**4.3**	**4.4**	**4.5**	**4.6**	**4.7**	**4.8**	**4.9**
Introduction	Research Models	Research Philosophy	Research Approach	Methodological Choice	Research Strategy	Time Horizon	Data Collection Methods	Summary

4.9 Summary

This chapter introduced the epistemic underpinning of this research in terms of ontology as situated in the interpretivist and social constructivist paradigms, from the view that reality is a social construct only given meaning by people. In terms of axiology, this research assumed subjective, value-laden criteria, and in this way the author constructed his own ‘truth’ of the social circumstance that leads to critical interpretation and the gradual construction of conclusions. Subsequently, this research sought to explore complex phenomena in context-specific settings and therefore adopted a multi qualitative approach to research, adopting a qualitative survey, configured to study diversity (not distribution) in its chosen population and not seeking to establish rates of occurrence, means or any other parameter, but aiming to determine the diversity of a topic of interest within a given population (Jansen, 2010). Finally, two different data analysis techniques were adopted, which include Thematic Analysis (TA) and interpretive structure modelling (ISM) in order to overcome the data collection limitations and enhance trustworthiness and rigorousness. The multiple sources of data adopted in this research have enriched the findings and produced insights into the research topic.

Chapter 5

Research Findings and Discussions

Sections

5.1	5.2	5.3	5.4	5.5
Introduction	Research Context	Method of analysis	Interview Findings and Discussions	Summary

Chapter 5. Research Findings and Discussions

5.1 Introduction

The Systematic review in Chapters 2 and 3 indicates that SBMs for the HCI have great potential for creating, delivering and capturing sustainable value. Developing a SBM will bring about systematic transformations in the HCI and shape it for a sustainable future. Chapter 3 establishes a conceptual SBM framework that forms the guiding proposition to research methodology in the methodology chapter. The SBMs framework is crucial for research design and for conducting an empirical analysis. This chapter is dedicated to accomplishment of the exploration methodology and reporting of practical discoveries obtained from the gathered information and analysis. Results of this study are divided into six themes and sections. Sections 5.2 and 5.3 provide the background of the research scope, main characteristics, information about interviewee profiles and selection criterion, interview processes and method of analysis for the merging themes. Section 5.4 discusses findings from the qualitative methodology of this study, the six emerging themes in SBM and data collection. Section 5.6 provides a summary of this chapter and concluding notes on results.

5.1	5.2	5.3	5.4	5.5
Introduction	Research Context	Method of analysis	Interview Findings and Discussions	Summary

5.2 Research Context (Kingdom of Saudi Arabia)

The scope of this study is located within the Kingdom of Saudi Arabi. The country, situated in western Asia, was founded in 1932 by King Abdul Aziz Al Saud, when the four regions of *Alhehaz, Najd, Alahsa and Asir* were united. Covering an area of some 2,150,000km2, about 80% of the Arabian Peninsula, it was later divided into thirteen provinces, each with a principal city for administrative purposes figure (5-1) (GIA, 2018). The country is predominately a desert nation-state that was catapulted into the global scene following discovery of its massive oil reserves. According to the International Monetary Fund, the Saudi economy is the largest in the Middle East and 18th in the world (IMF, 2018).

The rule of the Kingdom of Saudi Arabia is a monarchy, and its current ruler is King Salman bin Abdulaziz Al Saud. The constitution is based on the principles found within the Islamic Holy Book, the Quran, and the principles of Islamic Law.

Fig 5-1: Map of Saudi Arabia (source (HPDP, 2016)

The total population of the country was 31.7 million in 2016 (Central Department of Statistics-Demographic, 2018) and demographics show that 50 per cent of its population is under 25 years old, making it one of the world's youngest populations and implying intense future housing demands. Further, the country has a high per capita land area ratio of 83 m_2, and a low population density of 14 people/ m_2. This has motivated the government to support the vision of growth and expansion outside the historical already-populated cities.

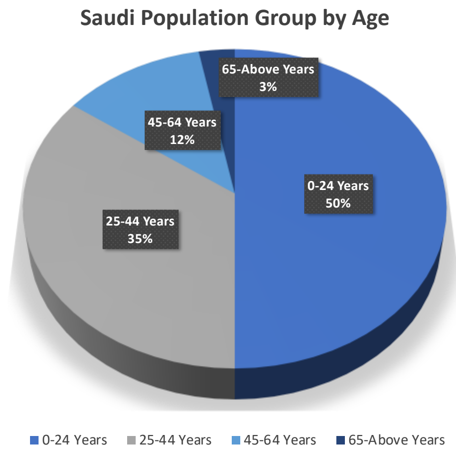

Fig 5-2: Saudi Population by Age Group 2018 adopted from Central Department of Statistics & Information (2018)

Riyadh, Makkah and the Eastern province regions host 50.5% of the population collectively due to the business, political and religious activities see figure (5-2). The population of the capital city, Riyadh, is 5.71 million, Makkah 1.9 million, Jeddah 3.9 million, Madinah 1.3 million and Dammam 1 million (Central Department of statistics-Demographic, 2018). The growth of urban population varies between cities, as shown in figure (5-3).

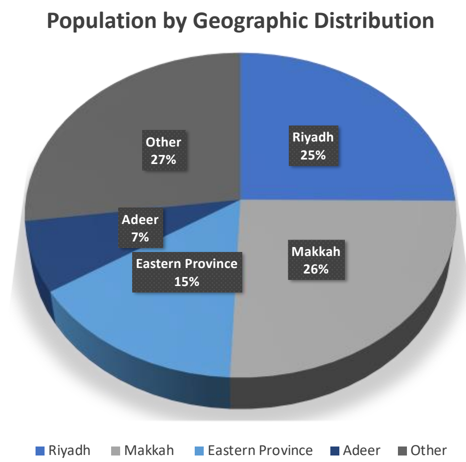

Fig 5-3: Saudi Population by Geographic Distribution 2018 adopted from Central Department of Statistics & Information (2018)

Information shown below from the Census provides a snapshot of conditions in Saudi Arabia from the Housing Program Delivery Plan (HPDP) report:

- The growth rate of the total population in 2016, the latest estimate, was 2.54% (World Bank Data, 2016),

- Three cities out of two provinces accounted for 57.13% of the total population
- Saudi citizens accounted for two-thirds of the total population
- 49.9 % were female, and 50.1 % were male
- The average monthly salary for a Saudi has increased by 30% since 1980, approximately $20,300 a year at the end of 2016.

The report also provided specific information at the HCI level:

- Statistics indicate that 65-70% of citizens are renting,
- Goal is to increase Saudi household homeownership rates to 60% by 2020,
- Plans to boost real estate funding by increasing total mortgages to SAR502 billion by 2020, and to
- Increase affordability by reducing the ratio between the average residential unit price to the annual income per capita.

Saudi Arabia has just introduced a tax system, as it was relying on oil income, customs duties, and licensing fees to produce government revenue. The Saudi legal system applies what is called the Zakat, an annual 2.5% assessment of a person's net personal wealth. The Zakat income assists social services, such as health care and education. Organisations in the new taxation system pay for income taxation equal to 5%. In the housing industry, the government in 2014, due to high land prices, announced new tax regulations for undeveloped land *(White Lands)* to unlock land and provide more housing units. The following sub-section discusses the scope of the research in more detail.

5.2.1 Characteristics of the Saudi Housing Construction Industry (HCI)

The HCI in Saudi Arabia is the scope of this research and it is considered one of the biggest and rapidly growing industries in the Middle East, with projects valued at more than one trillion dollars (Deloitte, 2014). The industry has been instructed to build more houses, develop the infrastructure – including airports and train stations – and build 11 sports stadiums with capacity for 45,000 fans. The increasing demand for housing has reached 1.45 million, with a significant increase in demand in several cities across the country figure (5-4). It is expected that 2.32 million new housing units will be built in the country by 2020 and an estimated SR64 billion will be needed annually to build around 145,000 new housing units per year up to 2020 (JEG, 2016). Figure (5-5) shows the yearly incremental demand for new housing units in Saudi Arabia.

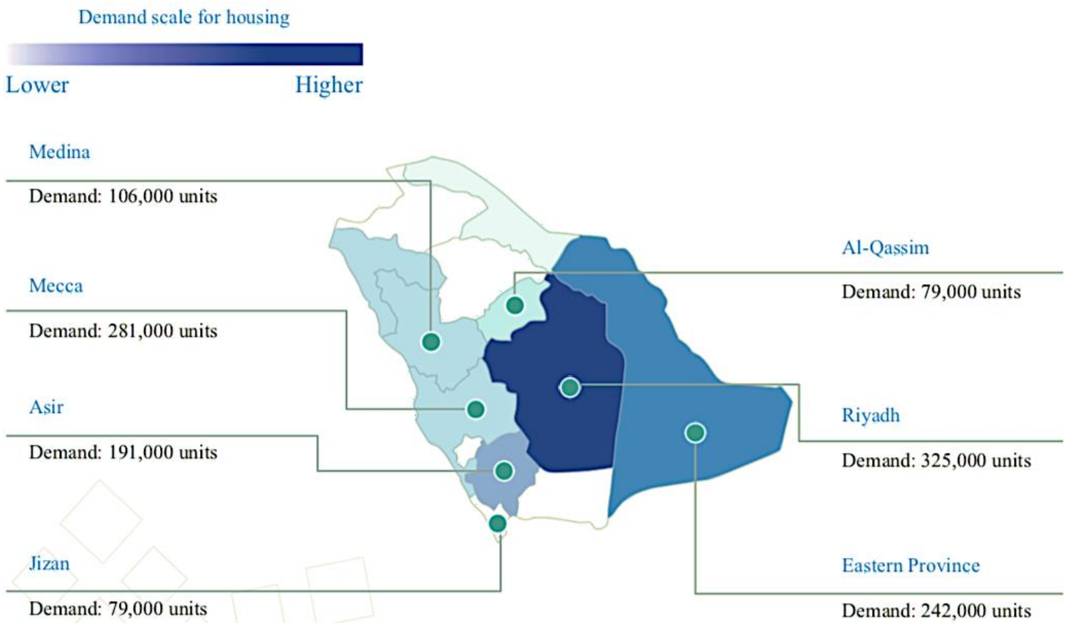

Fig 5-4: Demand in major cities adopted from HPDP (2016)

Fig 5-5: Yearly incremental demand for new housing units: 2005-2020 adopted from HPDP (2016)

5.2.2 *Parties involved in the HCI and sustainability agenda in Saudi Arabia*

Different governmental institutions guide the Saudi HCI. They set the general roles and policies for the industry. In the meantime, other public and private agencies are engaged in the housing industry, such as developers, contractors and consultancy officers, working in the development phase, starting with plan approvals, provision of infrastructure networks, construction of houses and maintenance and operation. Currently, there are four main state bodies at the highest administrative level that take the lead on housing industry policy in the country. These agencies and their responsibilities are described in table (5-1) below and figure (5-6). Their main headquarters are located in Riyadh city where interviews take place with legal parties. On the other hand, interviews with developers and professionals in the HCI take place wherever there is the highest population and related demand; in this case it was Riyadh, Jeddah, Makkah and Dammam city figures (5-3 & 5-4).

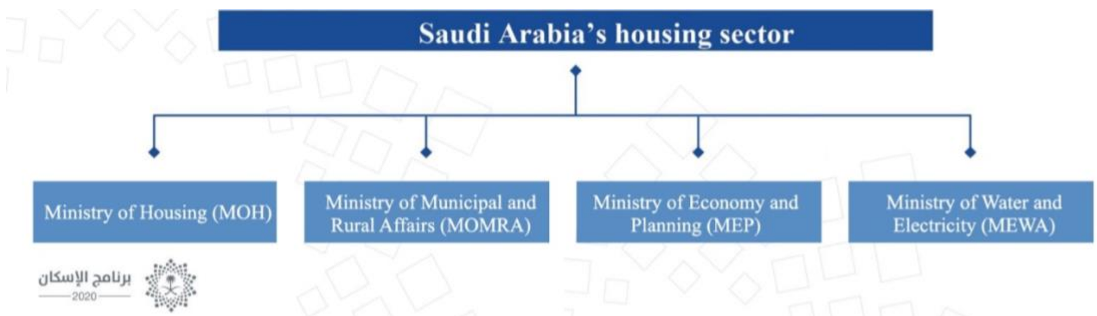

Fig 5-6: Housing Sector Parties adopted from HPDP (2016)

Table 5-1: Ministries and Agencies associated with HCI adopted from HPDP (2016)

NO	Agency	Responsibilities
1	Ministry of Housing (MOH)	Head of the country's HCI
2	Ministry of Municipal and Rural Affairs (MOMRA)	Responsible for a wide range of tasks, such as the spatial distribution of settlements and execution of urban planning within the selected areas. Also, issuing and licencing housing services
3	Ministry of Economy and Planning (MEP)	Top administrative level in terms of following and applying the Sustainable Development Goals (SDGs). Sets the main principles for economic development strategies that influence housing strategies directly and indirectly
4	Ministry of Water and Electricity (MEWA)	Responsible for electricity, water and sewage services

The Saudi government, during the last decade, has paid substantial attention to environmental issues, preserving biodiversity and natural resources, and providing a better quality of life through its Vision 2030 plans, followed by the NTP program. It has contributed significantly to Sustainable Development Goals (SDGs), launching several guidelines, policies and reports from agencies playing significant roles in achieving SDGs in the country. These bodies and agencies and their roles are shown in table (5-2) below.

Table 5-2: Agencies associated with SDGs in Saudi Arabia

NO	Agency	Responsibilities
1	Presidency of Meteorology and Environment (PME)	Protecting the environment at the national level. The PME and MEP are jointly accountable for implementing and monitoring SDGs in the country
2	National Commission for Wildlife Conservation and Development (NCWCD)	Protecting both terrestrial and marine wildlife, maintaining ecological balance and biodiversity in addition to conservation of environmental and natural resources
3	Ministry of Environment, Water and Agriculture (MEWA)	Maintaining pasture, forestry, animal resources and managing and sustaining water resources, sewage system and generation of power
4	Ministry of Energy, Industry and Mineral Resources (MEIM)	Managing and sustaining energy industries
5	Saudi Energy Efficiency Centre (SEEC)	Preserving the national wealth of energy sources in a way that supports the national economy and forces.
9	Electricity & Cogeneration Regulatory Authority (ECRA)	responsible for regulating water and electricity industry
6	The Saudi Building Code National Committee (SBC)	Setting standards and specifications for building in the country.
7	King Abdulaziz City for Science and Technology (KACST)	Sharing specific environmental concerns with science and technology ministry and other agencies.
8	Quality of Life Program 2020	Setting the process for each agency in the country to achieve Vision 2030 goals to make the Kingdom the best destination for citizens and residents.

The HCI has significantly developed over the past decade and is ready to benefit from the three trillion USD planned up to 2020. Government initiatives to rearrange the economy will further drive HCI growth as well as initiatives to support sustainable construction practices, which total 170 construction projects covering 14 million square feet. The HCI is positioned to incorporate and adopt sustainable construction practices. Currently, there are 30,000,000 square meters of LEED-certified space and, since 2010, the country has spent US$168 billion on sustainability practices. This has improved industry competitiveness and deployed investments to boost the growth of the Saudi HCI.

5.1	5.2	5.3	5.4	5.5
Introduction	Research Context	Method of analysis	Findings and Discussions	Summary

5.3 Method of analysis

The information presented in this section is organised according to data collection relating to research questions and outcomes of exploration rather than use of case studies from the HCI. This approach is adopted for the purpose of obtaining in-depth information regarding the development of the SBM through use of semi-structured interviews. The objective behind developing semi-structured interview questions was primarily to meet the below mentioned objectives:

- Detect the definition of the SBM and the participants' overview of the SBM in the HCI
- Discover existing BMs used in the HCI and identify the BM elements. This will help to understand requirements in each element of the SBM, such as Sustainable Value Proposition (SVP), Target Customer (TC), Distribution Channels (DC), Customer Relationships (CR), Value Configuration (VC), Key Resources (KR), Partner Networks (PN), Cost Structure (CS) and Revenue Model (RM)
- Identifying changes required for the transformation to the SBM
- Classify and group the challenges, based on PESTEL framework, that need discussion and resolution and find possible opportunities using the new SBM
- Conceptualise the social, economic and environmental benefits that a company can gain by using a SBM.

A mixture of theme coding and interpretation is used in order to easily analyse the semi-structured interviews. Thematic coding is appropriate for creating a strong relationship between primary and secondary data, such as the framework developed by researchers. The results formulation approach is particularly useful for semi-structured written information, as the participants encounter the equivalent coding through multiple rounds of questions. Use of colour coding identifies text passages and data covering similar hypothetical or illustrative ideas (Gibbs, Gibbs & Neill, 2014) as participants in the study may not answer questions relating to a particular theme, which can be captured during unstructured interviews. Based on the coding principle, data from original transcription was divided into 6 sections, as depicted in table 5-3. The objective is to take matching types and discover associations that create the foundation for clarification.

Interpretation is the process of finding and explaining answers to ‘How’ and ‘What’ questions. Interpretation requires highlighting results and placing patterns in analytical frameworks (Patton, 2005).

Table 5-3: Key Sections from the Findings

Theme	**Explanation**
Participant’s Details	Clarifying the participant’s background, demographic and expertise
SBM Definition	Conceptualising the definition of SBM and overview of the participants
SBM framework and elements	Detecting elements in existing BM and exploring ideas in each element of the SBM, including; Sustainable Value Proposition (SVP), (2) Target Customers (TCs), (3) Distribution Channel (DC), (4) Customer Relationship (CR), (5) Value Configuration-Key Activities (VC), (6) Core Capability – Key Resources (KR), (7) Partner Network (PN), (8) Cost Structure (CS), (9) Revenue Model (RM)
Changes required for transformation to SBMs	Identifying changes required for transformation to the SBM
Challenges of SBMs	Classifying and grouping challenges, based on PESTEL analytical framework, to be resolved to unlock possible opportunities provided by the new SBM
Benefits of SBMs	Conceptualising the social, economic and environmental benefits to be gained from the SBM internal to the companies.

From the table above, key themes are extracted using data collected from semi-structured interviews.

5.4 Findings and Discussions relating to Qualitative (semi-structured) Interviews

This part presents the outcomes from interviews and analysis using qualitative methods. The number of times a particular response occurs may imply a degree of relevance, but explicit situations and incidents will be well-thought-out and reflected in results due to the richness of the interpretive data. The next subsets present and explain the key themes, as apparent from the interviewees. Figure (5-7) presents a Nvivo 11 snapshot of the theme's hierarchy for the qualitive data findings.

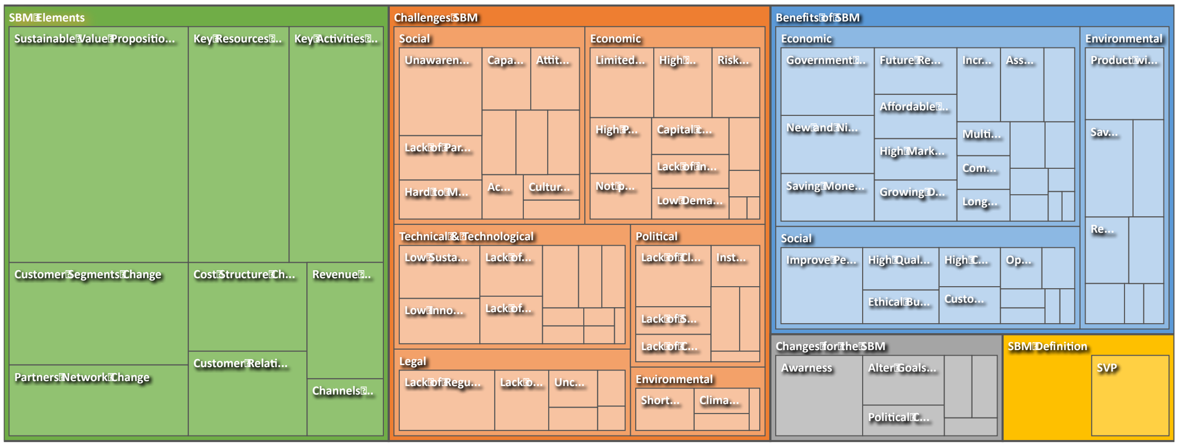

Fig 5-7: NViVo Screen capture of the hierarchy for the developed themes

5.4.1 *Participant Details and Background*

According to research methods detailed in Chapter 4, the purposive sampling technique was implemented to gather data and is useful for creating a grounded view of an individual's belief in a practical setting (Renukappa et al., 2012). This study conducted interviews with 22 participants, including stakeholders in the Saudi housing construction industry; i.e., Ministry of Housing (MoH), Presidency of Meteorology and Environment (PME), Ministry of Water and Electricity (MoWE), Ministry of Municipal and Rural Affairs (MoMRA), Saudi Energy Efficiency Centre (SEEC), University members (UN), Chief Executive Officers (CEO), Chief Finance Officer (CFO), Consultants (CS), Contractor (CO), Architect (AR), and Real Estate Developers (RD) (see table 5-4). Of the 22 interviews, one interview was managed by telephone and three participants offered textual answers before the meeting. The remaining interviews were conducted at the interviewees' place of work and lasted for approximately two hours. All interviews were recorded and transcribed for the coding and analysis phase. Interviewees were obtained from the Ministry of Housing (MOH) in Saudi Arabia and through attendance at housing events and conferences on sustainability and green building construction; for example, the International Conference on sustainability in Saudi Arabia 2017 see table (5-5).

An information sheet containing the research questions and requesting contact information was sent to each participant. After obtaining approval to partake in the research, the date, time and location of the meeting were organised, based on the preferences of the participants. Additionally, the participants' websites were reviewed to familiarise the researcher with the main activities and sustainability approach taken by the participants' organisations. This approach helped the researcher to modify interview questions accordingly for relevance and reduced ambiguity, therefore collecting better insights into the subject. The researcher met interviewees in a quiet place, which was conducive to deep thought and notified interviewees that the interview would be audio-recorded. All interviews were then transcribed, translated into English and analysed, using content analysis and thematic analysis techniques.

On the day of each interview, participants were given notification of the objective of the research and the range of the discussion. Consent forms were provided and signed by the participants. The consent form outlined the information to be obtained and a brief outline of the purpose of this study. Each participant was assured that the information would be kept confidential and names would be erased from the study following the data analysis stage. Interviews started with a brief discussion and general questions on the type of business the firm was into, job roles and obligations, experience of staff, and the size of organisation. The interviewees were found to have considerable experience in the housing construction industry and to be particularly knowledgeable on sustainability and green building development matters. A list of the key stakeholders associated with the development of the sustainable business model and the number of participants is shown in table (5-4), and an explanation of each participant's profile is provided in table (5-5).

Table 5-4: List of the key stakeholders associated with the development of the SBM

No	Stakeholder	No of Participants	Name
1	Key Agencies	4	The Ministry of Housing (MoH)
2		1	The Presidency of Meteorology and Environment (PME)
3		1	The Ministry of Water and Electricity (MoWE)
4		2	The Ministry of Municipal and Rural Affairs (MoMRA)
5		1	Saudi Energy Efficiency Centre (SEEC)
6	Practitioners	6	Real Estate Developers
7		3	Contractors
8	Professional s	1	Consultant
9		3	University Professors

Table 5-5: Participant's Details

NO	Participant	Participant ID	Position / Qualification	City	Experience
1	Ministry of Housing	MH1	Director of BMO	Riyadh	21
3	Ministry of Housing	MH2	Executive Director of the Saudi Real Estate Department	Riyadh	11
4	Ministry of Housing	MH3	Green Strategy Marketing Manager	Riyadh	9
2	Ministry of Housing	MH4	Manager of Stakeholders' Engagement	Riyadh	9
6	University	UN1	Professor of Environment & Urban Design	Makkah	32
7	University	UN2	Professor of Housing and Environmental Design	Jeddah	35
8	University	UN3	Professor of Sustainable Architecture	Riyadh	36
5	Consultant	CS1	Social Responsibility for Companies Consultant	Dammam	22
10	The Ministry of Municipal and	MM1	Capital Program Director & Assistant Prof of Civil Engineering	Jeddah	25

	Rural Affairs (MoMRA)				
9	The Ministry of Municipal and Rural Affairs (MoMRA)	MM2	Operational Facilities Manager & Urban Planner	Jeddah	21
11	Saudi Energy Efficiency Centre (SEEC)	EE1	Consultant & Assistant Prof of Electrical Engineering	Riyadh	12
12	The Presidency of Meteorology and Environment (PME)	ME1	Consultant & MSc of Electrical Engineering	Riyadh	15
13	The Ministry of Water and Electricity (MoWE)	MW1	Consultant & MSc of Hydrology	Riyadh	16
14	Real Estate Developer & Contractor	RD1	CEO & Renovation Manager	Jeddah	14
18	Real Estate Developer	RD2	CEO & Prof of Architecture	Riyadh	34
19	Real Estate Developer & Contractor	RD3	CFO & MBA	Riyadh	20
15	Real Estate Developer & Contractor	RD4	CEO & Sustainability Manager	Jeddah	15
16	Real Estate Developer & Contractor	RD5	CEO & Prof of Housing	Makkah	33
17	Real Estate Developer & Contractor	RD6	Senior Sustainability Consultant & MSc Process Sustainability	Dammam	11
20	Contractor	CO1	CEO & Associated Architect	Riyadh	15
21	Contractor	CO2	Project Manager & Engineering Value Director	Riyadh	14
22	Contractor	CO3	Associate Director & Urban Retrofitting	Riyadh	11

Based on the table above, different themes were extracted, and data was collected using semi-structured interviews.

5.4.2 Definition and Understanding Sustainable Business Models

As the objective of this phase was to develop a clear and reasonable definition of SBMs, the role of professionals, including practitioners and specialist members in the industry, and leaders from government agencies directing, planning and managing housing construction activities, were explored and considered. Practitioners engaged in the HCI reported interesting changes required in the proposed SBMs framework and they envisioned such transformation within the HCI by providing examples, cases and knowledge from existing housing market models. Participants felt it was necessary to shift focus from the relatively environmentally-conscious model and transform it to a SBM spanning environmental, economic and social sustainability agendas, all in one model. Industry professionals argued in favour of BM redesign to achieve socio-environmental and economic goals in the HCI. Further discussion on the meaning of the term SBM, its definition and framework and whether their firm's BM was transformable, keeping the triple bottom line objectives, was undefined.

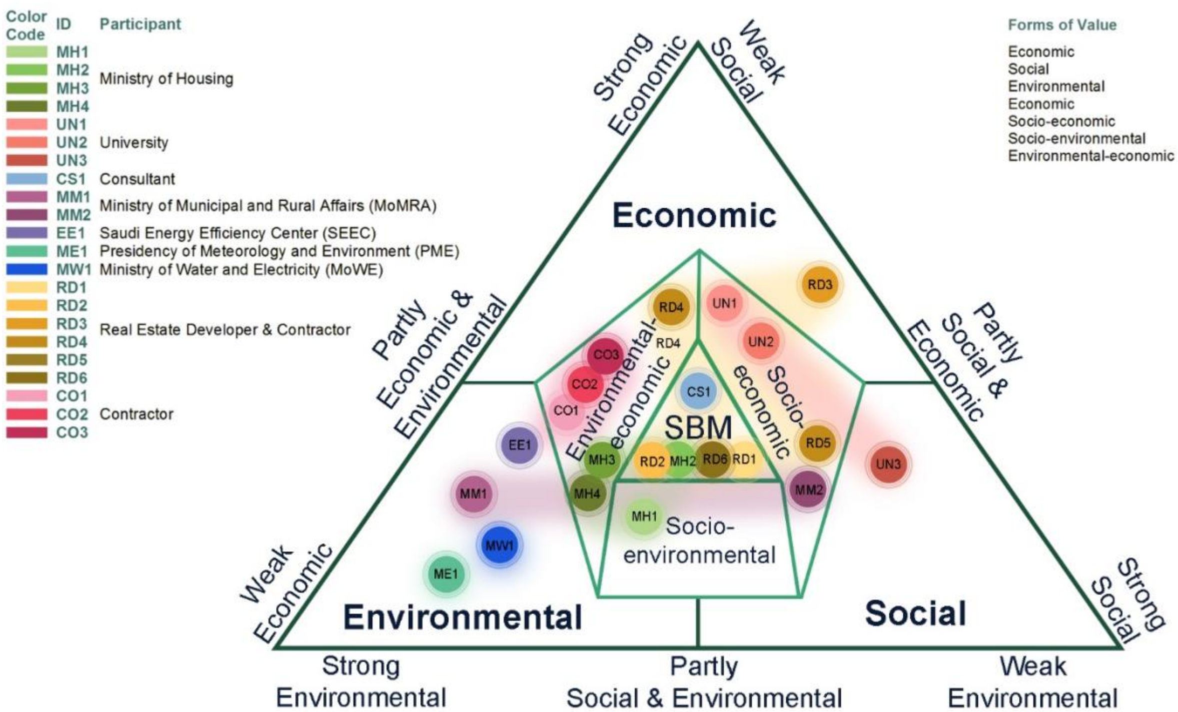

Fig 5-8: Participants' Taxonomy Pattern for the SBM definition (triangle view)

Figure (5-8) above illustrates the three pillars of an SBM that a must be considered by a business to create sustainable value for customers. These findings can be aligned under the three dimensions or a combination of two dimensions; for example, socio-economic. While the participants expressed many opinions along the lines of economic, environmental and social benefits, challenges and changes needed in the firm and external conditions, their views of SBMs can be placed in one of the categories, as shown in figure (5-8). Their position in the sustainability triangle is based on the number of stating the pillar of sustainability, using the Nvivo interviews database (see Appendix 6). The diagram shows a variety of opinions and perceptions in relation to sustainability practices in the HCI. In a similar vein, participants expressed the same variation of opinions in relation to SBMs, and this is because participants considered the SBMs in their relative contexts and shared their experiences in association with sustainable forms of development.

Participants held unique positions on the three-dimensional structure of value creation. For example, RD3 talked in detail about the economic benefits that a SBM brings to the organisation. Similarly, UN3 was one of the participants that thought social value was the major influencing factor in SBM development and should be at the heart. However, four participants held that environmental benefits bring sustainable value creation for the target customer. The limitation in developing a SBM was in motivating firms seeking benefits in one dimension to engage in value creation using the other dimensions. Some participants were placed in this category. MH1 favoured socio-environmental aspects of development, such as land use consideration combined with green building construction methods. Five participants, UN1, UN2, RD5, RD6 and MM2, placed greater emphasis on socio-economic advantages within SBM transformations. Among all the participants, CS1, RD1, RD2, RD6 and MH2 had a balanced view, giving equal importance to the three pillars of sustainability in the SBM. Participants that favoured only one dimension in terms of their views on sustainability and SBM development were unable to identify the benefits identified by participants from other sectors. The participants' response reflects their business position as well as knowledge on the topic. Therefore, participants that were unable to see value creation opportunities in more than one dimension could benefit from the SBM approach. The participants that could visualise SBM as a constitution of interrelated elements that served to fulfil the triple bottom line objectives under a systems-based view of thinking understood the concept accurately.

With regard to understanding and defining SBMs, professionals reported an overall positive outlook on the sustainability agenda that was linked to customer satisfaction and engagement. Practitioners in the HCI had deep knowledge and experience in delivering low-cost housing BM solutions that respected the triple-bottom line. However, the term ‘Business Model’ was not familiar to the industry professionals and leaders (Pekuri et al., 2013; Zhao et al., 2016). In a similar way, the term ‘sustainable business model’ was also unexplored. The SBM definition was placed closer to the housing and construction lifecycle management concept, taking economic, environmental and social costs into consideration (Zhao et al., 2016). Professionals were aware of driving forces acting on their BMs and the opportunities available, but their own understanding of the meaning and scope of a BM was limited (Zhao et al., 2016). Despite having limited schematic knowledge of a BM or its elements, professionals discussed how they had started embracing changes that were sustainable, such as customer-focussed philosophy, computer aided modelling and hiring environmental experts from universities to protect their BMs from challenges and threats faced in the Saudi HCI. There is a lack of explicit methodology for a firm needing to change its BM and BM elements when they are developing green projects (Abuzeinab, 2015; Mokhlesian & Holmén, 2012; Zhao et al., 2016).

A clear and specific understanding of the term SBM was requested by the interviewer to capture its relevance in context with the Saudi HCI. The response was largely demonstrated through existing housing construction projects of the businesses. However, some professionals viewed SBM development as bringing sustainability in all, or nearly all, the processes concerned with creating a product. Some real estate developers viewed the SBM as including sustainability primarily in the construction phase, followed by economic and social sustainability initiatives; and others viewed sustainability cover all the process phases. However, the contractors that participated in the study viewed sustainability in the BM as a combination of three crucial pillars on which the business operated. Discussions on the financial aspect of the construction phase, such as profitability and cost management, generated interest during interviews. Knowledge of BM elements was unclear among participants. However, drivers that necessitated SBM transformations, such as adoption of Saudi Building Code (SBC), Vision 2030 and other such projects, started to attract a growing interest and enthusiasm in line with sustainable construction in the HCI. Professionals in general viewed sustainability from different angles, such as design level changes, customer relationship marketing and collaborations, and used different pathways to achieve sustainability within their businesses, companies or institutions.

The data provides evidence that professionals, such as contractors (CO1, CO2 and CO3) and real-estate developers (RD1, RD2, RD4, RD5 and RD6) had deeper knowledge and insight in the composition of a SBM compared with leaders, such as program directors (MM1) and project managers (MM1) working with MoMRA, as they viewed the SBM in line with project management and boardroom decision-making. Developing a definition of SBM through the insight of professionals working in the HCI could prove useful in times of unstable energy prices, political and social turmoil. Furthermore, participants argued in favour of increasing dependencies between profitability and sustainability as the way to move forward in existing and new housing construction projects. The concepts of SBM and shaping elements are essential from the interviewer's perspective and viewed with equal concern or urgency by the participants. However, absence of a clear BM definition among the participants correlated with the assumption that businesses did not consider spending resources on identifying their value propositions, customer segments and financial logic a priority. Some professionals thought of the SBM in terms of creating sustainable value, while others focussed on value capturing mechanisms, and a few mixed it with value delivery. The environmentally sustainable value creation logic discussed in this study is consistent with the ZCB model approach (Zhao et al., 2016), BMs developed for Finnish construction companies (Pekuri et al., 2013) and stakeholders' engagement in green BM development (Abuzeinab & Arif, 2014). Most professionals interviewed presented their own ways to capture value via housing delivery projects. Despite having strong working business knowledge of the Saudi HCI, professionals provided innovative, yet empirically unproven, ideas to tap into future housing needs that reflected their confused approach to delivering and ensuring sustainable practices.

According to CS1, "*…sustainable business model transformation required innovations that led to lesser use of natural resources and had less environmental, economic and social damage"*. Therefore, the SBM is poised to emerge as a model ready for the future, as prices of energy, water, construction materials remain difficult to predict due to changing political, environmental and social conditions. Practitioners discussed the difficulties in delivering housing with fixed costs in Saudi Arabia. CO3, RD1 and RD6 argued that sustainable value propositions could provide a significant competitive advantage to firms (Bocken et al., 2014). However, the literature (Brege et al., 2014; Pekuri et al., 2013) suggests that businesses may face difficulties in defining and creating SVPs in the absence of a SBM. A common idea, reflected among real-estate developers, university professors and leaders in the HCI, was that SBM transformation needed to begin with models that put the customer at the centre of all activities in a HCCs engagement. As such, RD6 argued that, "*…well…if the model doesn't put the customer need first this will be the highest risk and not sustainable. SBM needs to determine the needs before the actual development process, this could happen by sitting with the prospective customers and determining their needs and what they prefer for their society and the environment"*. As such, ideas for BM innovation, as expressed in Anumba & Ruikar (2002), such as e-commerce BMs to create B2C collaborations, had applications in SBM transformations. A holistic view of identification, design and transformation of BMs into SBMs revolves around three core functions: the way a business engages customer segments in a way that leads their companies to make sustainable profit from delivering green projects that enhance its social desirability.

Based on interviews, two themes dominated discussions on SBM transformations. The first theme commonly accepted the need to internalise sustainability in every step. This approach absorbed all sub-segments of the value chain within the project delivery process. The SBM takes a lifecycle-driven approach that begins with understanding the needs of customers and ends with servicing their needs throughout the project lifecycle. In the SBMs framework, HCCS could accurately estimate costs incurred throughout the lifecycle of a proposed housing project and could offer sustainable solutions to their customers even before any actual construction. Also, the SBM view enables HCCs to map social benefits for its customers leading to revenue generating opportunities in the future. Confirming this view, RD1 stated, "*…to be sustainable there should be a source of sustainable revenue for the organisation; for example, not transferring all the housing development to the owners. We need to keep some of the land for the model itself for future development as time and demand will increase future development land prices. The sold properties will continue to make money for the owner, and it should be done so that, for example, the maintenance model* *generates and returns additional revenue and profit in the business model and so it should not be abandoned, should not take this property out of the circle and the scope for financial benefits".* HCCs were starting to experience the need to transition from the single sales of housing units to a community building project design and focus on a larger scale to achieve improved economic benefits. This type of large construction, however, requires design planning, collaboration with partner networks and understanding of ways to generate revenue streams. Participants were optimistic that such an approach could improve customer satisfaction and bring additional financial revenue options for the developing business and its partners as such developments ensure better living quality with green areas, mosques and shopping markets.

The second dominant and emerging view after discussions with the HCI leaders led to the understanding that sustainability has existed independently across the three pillars of economic, environmental and social sustainability. A SBM, as visualised by MM2, *"... should be customer oriented and also environmentally conscious as orientation toward the consumer is not enough; we need to think about using renewable resources in the model and use recycled materials."* The common idea behind developing a SBM, according to political bureaucrats and managers, rested on developing sustainable value propositions that were socio-economic, socio-environmental or eco-friendly. Therefore, proponents of the second theme did not place significant emphasis on the BM concept as a tool for identifying their unique BM elements or how they could use the concept as a tool to create sustainable value propositions.

Although the study was about the SBM, the interviews and data showed a lack of implementation of the BM construct in the HCI. While seeking clarity on how HCCs understood SBM and their points of view, noticeable caveats in their understanding and in the way they viewed the SBM were identified. Almost every industry professional placed sustainability as a top priority in meeting building construction processes through innovation in product, process or marketing. However, organisational innovation received greater emphasis from the specialised academic. In this regard UN3 said, "… *a SBM is the process for developing a sustainable product in an organised manner. It begins by assessing the needs of the customer and is based on the information in the system. The product is tested.*

The errors corrected, if any. Then the company should work to determine the price (the highest or lowest price) according to the customer's income and payment method. Undertaking organised work, the capabilities you need in the company when developing housing projects are skills in assessing, reviewing the social and technical value of the building, and consequently, developing the housing project, thus requiring knowledge, marketing and engineering skills." The benefits linked to the SBM can be realised when HCCs: a) identify opportunities that could generate economic, environmental and social value (Aho, 2013); b) are capable of understanding their own BMs application in green construction projects (Abuzeinab & Arif, 2014; Mokhlesian & Holmén, 2012) and c) can apply sustainability concepts in every process of the business, from customer engagement to building construction and lifecycle management.

The hindrance among some HCI professionals was in the way they approached sustainability. Some industry professionals, such as real estate developers and contractors, had preconceived notions that sustainability was limited to green construction (RD1, RD5 and CO1) and sustainable technologies and innovation (RD1), or creating green value in general (RD3, CO2 and CO3). They believed that the answer would depend on the application of sustainability, based on their firm's position to meet customer requirements. However, the meaning of sustainability was broad and depended on the extent to which an organisation wanted to be sustainable, and on the industry in which they sought sustainability. In this view, contractor (CO1) said that "*it will be hard for any business to be sustainable if the environment of the business is not ready or not sustainable*." Another contractor (CO2) spoke on the meaning of the term environment of the business, as mentioned by CO1. He said that a SBM not only generates economic value for the business and house owner, but leads to environmental and social value. Some of the real-estate developers (RD1 and RD6) believed sustainability meant everything, such as environmental, social, economic, political, educational and cultural aspects.

Following examination of interviews with housing construction stakeholders, some patterns in definitions were visible. Based on the above, the SBMs can be defined according to the following characteristics:

- Respect and work according to the triple-bottom line of economic, environmental and social sustainability
- Transform GBMs into SBMs by incorporating economic and social sustainability parameters
- SBMs are customer-centric models that adapt according to the dynamic needs of their customers
- SBMs provide a sustainable value proposition that offers customers short, medium and long-term benefits while sustaining the business that offers this value
- The financial logic is modularised into packages, each with its own SVP, rules of customer segments, partner networks and revenue regeneration logic

Recent studies have explored the uptake of green building concepts that lower carbon offsets to near zero (Zhao et al., 2016) or take up off-site construction (Pan & Goodier, 2011)to deliver housing projects that are a step ahead of traditional methods of housing construction. The aim of this study was to explore what SBM means for HCCs and how they could review their existing BMs in order to become more sustainable. Therefore, the scope of the SBM definition must include social benefits associated with housing development as well as environmental or economic sustainability and innovations. Despite the lack of new and radical improvements in housing design and construction, participants were of the view that unstable energy and water prices and fluctuating political and economic situations would create opportunities for their firms to revolutionise their BM for the transformation to SBM. The definition of the SBM formed during the interviews confirm the earlier version of the SBM that been developed during the conceptual phase. Participant suggested to stress the importance of adding socio-environmental vale by matching the TCs demand to eliminate damages to the environment in the working definition. Thus, the concluding definition of SBM in the HCI can be;

A plan for the HCC to provides socio-environmental improvements beside economic benefits by focusing on sustained value creation with clients/participants' roles at the core and by incentivising and engaging them in the value chain to minimise waste and environmental damage. Hence, the SBM represents the way HCC create, deliver and capture value by *addressing customer needs and upholding social, environmental and economic principles for the long-term benefits of the organisations.*

This definition covers areas in which a HCC can extend itself to learn, partner, collaborate and transform into a project basis. For instance, a project will modify its value proposition according to sustainability principles helping customers select from options that are targeted towards each of the individual dimensions. Therefore, the pace of adoption of SBMs to create value propositions backed by sound financial logic will depend on their uptake and the experience of builders, contractors and HCC professionals. Having presented a clear picture of a SBM, the next section will focus on the individual elements of the SBM.

5.4.3 Sustainable Business Model Elements

Based on the above clarification and the definition of the SBM, it is assumed that every HCC has a BM comprising nine major elements: Sustainable Value Proposition (SVP), Target Customer (TC), Distribution Channels (DC), Customer Relationships (CR), Value Configuration – key activities (VC), Core Capabilities – Key Resources (KR), Partner Networks (PN), Cost Structure (CS) and Revenue Model (RM). HCC that change one or more elements to become sustainable would have started on the path of transforming their existing BMs into SBMs. Every change brought about by the firms in these elements to become more sustainable will categorise that HCC as transforming into a SBM. Further specifications of these elements are illustrated in figures (5-9 & 5-10), based on the results of discussions between the interviewer and the participants from the HCI in Saudi Arabia.

Name	Sources	Referen...	Created On	Created...	Modified On
▶ SBM Definition	19	35	8/9/18, 1:25 PM	ADNAN	Today, 2:50 PM
▶ Benefits of SBM	0	0	9/10/18, 12:32 PM	ADNAN	11/23/18, 1:17 AM
▶ Challenges SBM	0	0	9/2/18, 3:52 AM	ADNAN	11/22/18, 10:33 PM
▶ Changes for the SBM	0	0	8/19/18, 4:51 PM	ADNAN	Today, 3:38 PM
▼ SBM Elements	0	0	8/25/18, 3:14 AM	ADNAN	12/30/18, 12:20 AM
Sustainable Value Proposition Change	22	172	8/25/18, 3:04 PM	ADNAN	Today, 3:08 AM
Key Activities Change	21	91	8/25/18, 3:04 PM	ADNAN	Today, 3:08 AM
Key Resources Change	18	96	8/25/18, 3:04 PM	ADNAN	Today, 3:08 AM
Customer Segments Change	17	75	8/25/18, 3:04 PM	ADNAN	12/30/18, 12:17 AM
Cost Structure Change	13	43	8/25/18, 3:03 PM	ADNAN	12/30/18, 12:15 AM
Customer Relationships Change	13	41	8/25/18, 3:04 PM	ADNAN	Today, 3:08 AM
Channels Change	12	17	8/25/18, 3:03 PM	ADNAN	12/30/18, 12:14 AM
Partners Network Change	12	51	8/25/18, 3:04 PM	ADNAN	12/30/18, 12:18 AM
Revenue Streams Change	12	36	8/25/18, 3:04 PM	ADNAN	12/30/18, 12:19 AM

Fig 5-9: SBM Elements Hierarchy

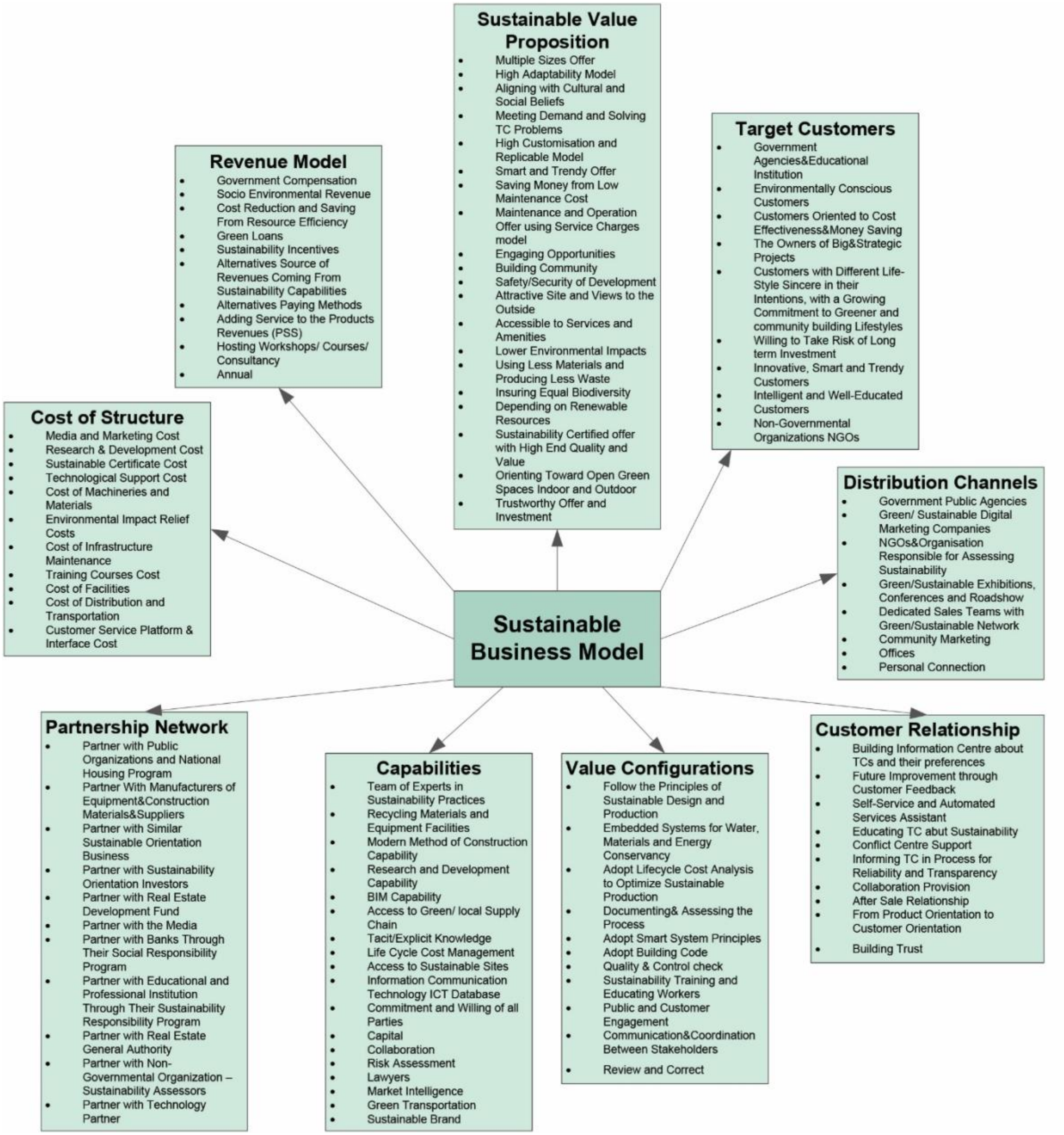

Fig 5-10: SBM Elements

Figure (5-10) summarises the participants response to each of the nine elements of the SBM. The elements are developed from an exhaustive literature review. The participants' answers are populated directly in front of each element. The bullets in the figure show emerged sub themes from the participants' responses generated for each element of the SBM. During this process, the sub themes (bullets) from the interview transcripts were identified, based on phrases or paragraphs commonly used when discussing the element. This coding list was then exported to NVivo as free nodes.

In the following sections, each element of the SBM is presented in detail. This is a discussion developed on the tenets of direct responses given by the participants during interviews. All successful BMs have shown a high degree of commonality in their elements, thus creating consistent reviews across the HCI. The elements reinforce each other by creating the value chain, starting with conceptual planning of the housing project and continuing to the end stages of the project lifecycle. Next, the analysis was further iterated thoroughly

- **Sustainable Value Proposition (SVP)**

The SVP is an appealing offer in the form of products and services in line with the triple bottom line approach offered by the HCCs. Participants believe that their firm's VP in the market is most important and is the driving force for their company's development. In other words, it is a direct offer to its customers, thus forming the basic building block of a BM. Products and services offered by a HCC define its value proposition which, in this study, is represented by the housing product and services attached to it. Based on interviews with the stakeholders in the Saudi HCI, including leaders, real estate developers, contractors, consultants and university professors, SVP was described using terminology that represented what customers expected from the HCCs delivering sustainable products. An extensive discussion took place between the participants for the development of this element. The emerged findings form a wide range of SVPs and characteristics, indicating the high importance of this element for the SBM framework development. This range of descriptions are available in figure (5-10) and the table in Appendix 7.

The emerged sub themes for the SVP shows that HCCs reiterated customers' expectations of the SBM as a value offering: to meet customers' demand and problems solving fulfilment, variety of sizes, adequate site selection and attractive views to the outside, adaptability, replicability, high customisation options, saving money and lowering maintenance cost, availability of renewable and smart technology solutions, maintenance model, low environmental impact, biodiversity, green spaces indoors and outdoors, accessibility to services and amenities, alignment with cultural and social beliefs, sense of community, safety and security, opportunities to engage and participate in the development, high-end quality and sustainability assessment certification. In meeting the housing demands of a globally rising population, SVP provides a possible mechanism to enable HCCs to address present and future housing challenges. This includes concerns experienced by consumers and way construction companies could find innovative solutions that benefit consumers and respect triple bottom line principles. SVP can be summed up in the words of CO1 as *"a process of developing a new and complete lifestyle for the residents"*. In other words, the SVP will insure not only what customers expected, but will go beyond and develop a new solution that will be ready for the future.

The participants continuously cited the importance of SVP design having the potential to meet the needs of TCs and address their problems. Developers and contractors reiterated, citing examples of ineffective BMs in recent housing construction projects where the developers misinterpreted the TCs' needs. As CO3 from the contractors group pointed out, "*... there are many housing units in the country today that are empty……because they rely on their experiences to match demand and they sometimes fail to recognise consumer preferences."* Thus, the marketing teams within a HCC focusses on whether their offers are competitive, smart and worthy of investment by targeted customers. Likewise, finance teams are required to carefully estimate the correct market value. HCCs could start evaluating existing value propositions, ask whether their present offerings meet anticipated future demand and whether their model and offers could be repeated in different and challenging economic, environmental and social conditions. MW1 had a similar viewpoint, stating, *"the product should be developed after studying customer needs, customer feedback and future recommendations before and after housing developments"*. These thoughts reflect the concerns raised by Aho (2013), who stated that enormous sustainable practices in the construction industry have oriented development of products, service technologies and systems, omitting industry structure transformation and BM innovation. Simply put, companies should involve and engage customers to understand their preferences, and then align the desired products, services and technologies to reach those goals. For example, Private Finance Initiatives (PFI) and Public-Private Partnership (PPP) models are principally based on customers' requirements, performance targets and providers, competing with competitors to fulfil them at the lowest life-cycle cost to the customer.

Evidence from the professionals suggests that failing to offer variety or small size SVP can impact negatively on customer satisfaction. These preferences can affect social life, for example, inability to work, study and relax in a quiet environment. Offering different sizes and solutions appears socially important for the development of the SVP. The variety of sizes also enhances future development of the TC and enhances the adaptability of the SVP. According to CO3, *"…companies create SVP with a variety of sizes as a result of clients' need and future expansion, and that enables future development of the SVP with minimum changes and costs to minimise financial, social and environmental waste…."*. The design layout can be adapted, tailored or expanded, depending on the changing requirements of the residents, to ensure a longer lifespan of the housing unit, providing a better quality of home life and sense of family by offering flexibility in design. Failing to offer such a proposition will impact financially and socially on residents, especially those who cannot afford to move from their housing unit.

Additionally, developers stressed the importance of site selection and view. In this regard, CO1 said, "*…selection of the site has many criteria, and good SVP can benefit from this and enhance residents' lifestyles, improve energy efficiency and quality of the indoor environment"*. When considering the climate and natural aspects, in addition to site selection, an inadequate SVP will impact the residents, as asserted by RD6: *"The proposed value proposition* [meaning SVP], *location and good views are going to help in establishing efficient design and will also ensure a sense of well-being and good quality of life in the development"*. While it would be impractical to expect attractive views from all spaces inside the house, pleasant views encourage a positive perception of the quality of the overall housing development (Royal Commission on Environmental Pollution, 2007).

One of the critical issues for the provision of affordable SVP is the difficulty in making accurate cost estimations and the high cost of sustainable features. Solutions suggested by the contractor group included use of a replicable model. The government bodies made a similar proposition. According to MW1, *"The profitable and smart business SVP should be based on a repetitive model"*. Discussion about replicability models show that the focus of such a model is on dividing the design to structural components that can create any design layout with standardised measurements and specifications. CO1 said, *"…the availability of technological solutions in the construction phase, such as modern methods of construction, will increase the customisation and the replicability of the produced value"*. Making a similar point, CO3 said, "… *the replicated model will lower the prices and environmental impacts, and this can be done using technologies and management programs such as LCCA"*. This is acknowledged in research conducted by Bamgbade, Kamaruddeen & Nawi (2017), which considers the flexibility of such solutions for adapting to users' needs and the environmental benefits of using fewer materials and energy in construction. Therefore, the professionals considered that this SVP has huge potential for achieving social, environmental and economic efficiency. The dilemma of relating price and earnings to the performance delivered to the customer and society can be overwhelming but not impossible if taking a structured approach.

The SVP can also be described as an innovative solution that uses renewable and smart efficient technology solutions for energy and water provision, such as the installation of solar photovoltaic (PV) panels, greywater systems, smart home systems. In relation to this, RD3 commented, *"In an era in which environmental challenges are elevated, use of renewable resources can alleviate these difficulties; and* CO1 made the point that '*energy and water bills are major expenses and customers aren't aware of solutions* on the market that will *save them money."* The participants expressed new acceptances and preferences for renewable resources instead of the conventional resources in new housing developments. This result is echoed in research conducted by Alrashoud (2019), which investigates the social perception of residential solar photovoltaic systems (RSPSs) in Saudi. The government recently released approval of RSPSs, releasing a list of certified contractors. This list will be released when contractors and suppliers meet the criteria required by the Electricity & Cogeneration Regulatory Authority (ECRA) (ECRA, 2017). Using such an idea also opens the door to money savings and reduced maintenance costs. The professionals conveyed ideas related to SVP, such as saving money by reducing bills for water, energy and maintenance with Product Service Systems (PSS) using renewable resources. The PSS combines products with services in the use-phase with contracting systems (Kurdve & De Goey, 2017; Sweetser, 2012). Firms should demonstrate excellence in all phases of design, construction, sales and management to gain experience and achieve money-saving and proven cost-effectiveness for the customer.

In addition, extending the SVP to include maintenance and operation models is considered an essential aspect. Practitioners highlight this idea suggesting monthly or annual charges. The charge is calculated based on the floor area of the house. Two categories of maintenance model charges could be introduced; a) housing unit scale and b) neighbourhood scale. The services could include exterior cleaning, door entry system, lifts, gardens, lighting, sink and toilets, CCTV, concierge service, cooling & heating systems, solar PV maintenance and repairs to communal areas. This model would enhance the efficiency and value of the SVP, providing high-quality maintenance services. RD1 stated, *"… here we are missing the culture of operation and maintenance services in the proposed PV, such a model is a great example for a win-win situation between the developer and the customers. The SVP should consider the relevance of such a solution."* In a related vein, Zhao, Chen, Pan & Lu (2017) analyse four leading sustainable building cases with innovative BMs and identify the extended operation and maintenance service as an innovative value proposition for green growth.

The participants also confirmed the importance of lowering environmental impacts and progressing low carbon SVP for a better future. This result is in line with the work of Abuzeinab (2015), who argues for the development of green value propositions. The participants also confirm that such value is an attractive solution for both customers and the government. For example, the Saudi HCI supports sustainability in construction practices by offering more than 14 million square feet of land in the country for sustainable projects (JEG, 2016). The consultancy participants from the government bodies stressed another important idea for the preservation of the biodiversity within the proposed SVP. This comes as a suggestion by ME1, who states, *"the SVP should be built without disturbing the biodiversity of the surrounding regions"*. On the biodiversity side, the participants supported inclusion of this parameter for enhancing vegetation and wildlife.

While the SVP design itself cannot develop social networks, provision of green spaces with specific structures, such as a courtyard, roof garden, seating areas, playgrounds and BBQ sites, can facilitate the development of social interactions, thereby contributing to the quality of life and well-being of the residents. MM1 said, *"… connecting to the nature is a massive need."* Another expression of the benefits of the green area is found in UN1's view, suggesting that such spaces would provide relaxation, own-enjoyment and recovery from stress, providing desirable social value for residents and enhancing self- expression. In this regard, there is a growing body of research presenting evidence of the positive impact of green spaces on the physical and mental health of residents (e.g., Sustainable Development Commission (SDC), 2008). Also, in a related vein, Aldersoni, Hou & Chow (2019) have researched the preferences of passive strategies for housing development in Saudi and identified the importance of green areas for annual energy consumption as well as the well-being of residents. This conclusion is in line with the report by the Royal Commission on Environmental Pollution on the Urban Environment (2007), which confirms the strong relationship between green spaces and health benefits.

There is evidence from the participants of the importance of accessibility to public services and amenities, such as mosques, education, healthcare, shops, entertainment and other facilities, as these facilities are associated with numerous social, economic benefits. Also, proximity to services within walking distance will reduce the environmental impact of motor vehicles and will enhance health by encouraging increased human physical activities, such as walking and cycling. Other suggestions made during discussions relating to health and well-being include amenities such as gyms, swimming pools, concierges, co-working facilities, gathering spaces and roof gardens.

Participants stressed that the SPV design is not only a matter of artistic appearance. The SVP housing unit is an element of society and culture. Thus, it should respect cultural beliefs (e.g., privacy, social solidarity and dignity). According to RD1, *"the Saudi society is conservative, and usually appreciates the idea of privacy, which is not easy to achieve. Thus, designers should take these cultural and social characteristics and beliefs into consideration"*. This indicates that integration of such values, identified both by leaders and professionals, should be a major element of a SVP. This result is in line with previous research conducted by Al Surf, Susilawati & Trigunarsyah (2013) who studied low-income families in Saudi and their requirements in the housing units. They found privacy to be a main requirement that could be achieved using various traditional Saudi architectural elements, such as decorative screening of windows, called Mashrabiya, inner courtyards for more inward-looking, and avoidance of windows and outdoor living areas directly facing neighbours.

With regard to the idea of a sense of community, there was a wide range of interpretation from the participants relating to the scale of this concept. RD1 argued that, *"sometimes, offering value propositions at the family level was not as much a priority as at the community level in terms of community development"*. However, participants agreed on the importance of both, as they lead to maintaining a strong connection and promote the growth of social capital, thus supporting and building healthy and sustainable communities.

Safety of the residents was an appealing SVP to firms, as also noted by Al-Jamea, (2014). RD suggested design changes, such as narrow lanes to reduce speed within the project and use of extra space for building pedestrian walkways. One aspect of safety expressed by contractors related to safety of workers during construction, which is compatible with the growing body of literature on safety in construction (H. Li et al., 2009). The practitioners, including contractors and developers, expressed appreciation and support for the Ministry of Labour and Social Development's (MLSD) site safety management systems. Therefore, a safety-driven environment was sought necessary during and after construction, ensuring both the workers' and occupants' safety and well-being.

The opportunity for both developers and customers to engage during and after the development of the SVP is an important part of the SBM. CO3, from the contractor group, found it necessary to update customers on the development timeline to enhance the validity of the SVP. Another developer, RD5, suggested the use of technology should be extended to use by the end-users to enhance the user experience by engaging them in the activities. Creating that relationship and trust with the TC is essential for the success of SVP, providing outstanding value and communicating the concerns and opinions of the TC and increasing the sense of community that helps to build social capital. In a related vein, Zhao, Chen, Pan & Lu (2017) raised the importance of stakeholders' collaboration in the design and construction phase as an innovative PV.

Finally, the participants raised concerns about the quality of construction, identifying achievement of high quality and finish as important aspects of the SVP. According to MH1, "*Customers value certified long-lasting products and dislike rubbish.*" Thus, as identified in discussions between participants, a certified product with a high market value would add value to future developments. According to CO3, *"If the product is of high quality and is sustainable, having, for example, LEED or BREEAM certification, this would enhance its value."* This conclusion is in line with that of Abdullah, Mohd & Sabu (2016), whose summing up of their investigation into Malaysian housing market prices with green certification confirmed a beneficiary relationship.

It can therefore be summarised based on the points made above that:

- The SVP provides the building block of a SBM by delivering as promised what a customer expects from a HCC in terms of addressing customer's concerns and meeting their requirements. To develop successful value propositions that are sustainable, companies may have to examine their service architecture and BM elements. Clarity in understanding customers' needs translates into what a company can do to fulfil those needs.

- SVP can be understood in many different ways by customers and HCCs. Companies must strive towards developing the most affordable housing with the lowest environmental impact and highest social gains.

- For any proposition to be sustainable, it should be replicable. SVP must respect the triple bottom line principles in every market of the country, and companies adopting SBMs will find they are able to modify value propositions according to client needs. SVPs will automatically attract customers from surrounding markets when HCCs can deliver products that provide maximum gains and with minimum housing-related challenges.

- Therefore, SVP translates into a process that begins, specifically, with accepting customer requests, understanding their most basic housing needs and aligning its business activities to deliver products and services as envisaged by the customer.

- For the VP to be sustainable, the company should expand the model from only provision of products to provision of maintenance and operation services, including the PSS for the renewable resources in a contracting model.

- Developing a cost-effective SVP depends on the space given to customers and other stakeholders to engage and collaborate in the phases of the development. As high as the communication are available as meeting demand and solving problems will be accurate.

- Developing a profitable SVP depends on how well it can be replicated and enhanced with every cycle. Not only is the development of SVP critical for the survival of a construction company, it is an opportunity for it to engage with people throughout the product lifecycle.

In essence, SVPs must focus on understanding the needs of Target Consumers (TCs). The next section reports on the participants' views regarding identification and engagement of consumer groups.

- **Target Customer (TC)**

A target customer is a set of people looking for products and services that satisfy their housing needs with good overall value and revenue potential for the developing company. Every value proposition is designed to be targeted at a particular customer segment. There may be individuals, families, small communities, small- and medium-sized industries, government and non-government institutions included in the mix. A housing business must design and create a different SVP for every TC encountered. Therefore, customer segments must find competent firms with the same enthusiasm as that of firms looking for potential customers in highly diverse and segregated markets figure (5-10) and table Appendix 8 lists the characteristics of different types of customers, based on interviews with participants from the Saudi HCI.

According to the participants, the public sector is deemed a viable opportunity that their firms should target. This result also came in another study by Abuzainb (2015) but in this task, the public sector agencies in the Saudi government needed to involve firms consciously and provide benefits that distinguished them from other firms, since they are applying sustainability efforts. Therefore, public sector projects have a major impact on the HCI as they are sought after by housing construction agencies. Project portfolios, however, can be differentiated for those firms that undertake projects financed by government and link their social sustainability agendas with environmental benefits to make their products desirable for a particular TC. As CO1 expressed that, *"The public sector in the country who make the sustainability agenda their priority and responsibility, will be my target customer by default."* However, according to some participants, it is difficult at present to see firms delivering high quality VP at low prices. The public sector should engage customers using technology to build relationships with those customers.

The participants stated that customers of all age groups and all customer segments have cost effectiveness and saving as their prime concern. CO1 said, "*energy and water bills are main expenses and customers aren't aware of solutions on the market that will save them money, and targeting such segments will at the top of priority"*. However, some TCs a) have no prior knowledge of sustainability because they haven't experienced it b) have knowledge and awareness of sustainable solutions because they have experienced it for some duration and c) have experienced sustainable living and want to enter or continue with sustainability-driven solutions. Therefore, HCCs have the opportunity to target TCs who are looking for cost effectiveness and money saving opportunities. Such important opportunities should aim to meet the needs of the end-user, whether for a single home or a large residential community. It must bring suppliers and partner within the sustainable value chain to meet the economic, social and environmental requirements of the customer or end user. The view held by CO1 on engaging government and non-government agencies as pioneers of SBMs rested on the argument that many public institutions and some private players believe in the long-term payoff from the investment, while being environmentally responsible. Since government institutions enable customers to live and work together within a safe environment for families and health facilities, they can be considered representative institutions working for the benefit of its people.

Besides government and non-government agencies, private players are owners of strategic projects that have taken big leaps in the implementation of SDGs. Owners of strategic projects in the country have shown how public-private partnership models can fulfil the needs of a particular customer segment. In this respect, use of PFIs and PPPs has shifted the responsibility for design, construction and operation from the government to housing development firms. Participants acknowledged the lack of integrated solution providers in the industry. They also reported a growing consumer demand driven by government PPP policies.

The role of the HCI is to identify the type of people who want a particular type of housing. Whether it is an individual or a large company, the HCC should be able to align its business activities so that every customer segment receives and benefits from the generated value. As there may be doubt in the minds of consumers before entering the housing market, it is the role of HCCs to make housing owners fully aware of the products and services available to cater for a particular TC. In the interviews, environmentally conscious TCs looking for comfort and savings were the most discussed (Abuzeinab, 2015). On the other hand, large-scale environmentally conscious institutions are in a better position to deliver environmentally-conscious and economically viable housing, mainly because of environmental restrictions in term of waste generation, energy use and financial aid to mitigate risk and absorb losses. TCs seeking single home solutions with customisations according to their affordability will require HCCs to work extra hard matching price with SDs objectives.

Another category of user, aware of SDGs but yet to see its application in homes and social circles, is emerging. It is the intelligent and well-educated TC who wants to follow a different, smart, efficient lifestyle that associates with greener lifestyles. Some customers seek innovative, smart and trendy solutions with the hope of improving their living conditions. Among this sub-category of customers, price may be matched to their expectations, but with limited success. According to MM2, "… *while the Saudis consumers are young, growing, and aware of sustainability issues, the dominant model of consumption is still closer to 'if the burger tastes good I'll eat it', and 'if the shirt looks good, I'll wear it."* This philosophy penetrates TCs who seek affordable housing, as highlighted by RD4, who said *"… sustainable products are not an end value for themselves. What is important for them is affordable housing"*. Homes built with less materials, replicable models, using recycled materials and strong and durable building materials will slowly replace the large amounts of natural resources that go in the development of traditional BMs. This will occur as the costs of SVP reduce further, while the prices of wood, cement, water and labour – which are prime construction materials – increase rapidly. Therefore, HCCs must figure out ways to improve their internal processes to help deliver sustainable value propositions for the TC. SBMs provide streamlined approach to show businesses how to create value for each customer segment with a SVP.

Some of the practitioners considered the suppliers in the value chain as TCs. That view came as an assumption and was located between a TC and a Key Resource in the BM (Abuzeinab, 2015). An example of such deceptive thinking is found in RD2's statement: "*suppliers with the same business orientation towards sustainability will be a customer for us because of their access to new projects and contacts. They will introduce new projects, and in some cases, they bring pioneering or strategic projects".* The same idea was expressed by CO3, suggesting that practitioners assumed the non-governmental agencies (NGOs) responsible for rating sustainability are possible TCs.

In discussions with the participants they asserted that TCs are invaluable part of the BM concept. Initially, all the community is considered a TC, later differentiating them according to their needs and capabilities. Going forward, firms will have value offerings of most benefit to customers who have signed a long-term agreement for maintenance and provision of a service for community development activities. This would make the traditional build-and-sell model costlier than the SBMs. According to RD4, "*sustainability customers are the same as traditional model customers. Sustainable products are not, on their own, end value products. What is important for the is affordable housing* ". Therefore, government projects could target large-scale developers to work on sustainability principles and persuade them to follow SBM guidelines; which may form a kind of PPP. Therefore, ministries and institutions like MOH and other educational universities could be targeted as a consumer segment as they are willing to risk a long-term investment. A TC with sincere intentions and a growing commitment to a greener lifestyle would create mutually beneficial relationships with firms committed to sustainable development. The ideas that define a TC and its role in the value chain are given below:

- A new generation of consumers, especially young consumers, environmentally conscious and aware of sustainability issues, is emerging that needs quality SVP solutions with low social, environmental and living costs.
- Some customers will continue to target low cost as their primary housing requirement over the surroundings. Thus, firms must define how to meet their needs while maintaining sustainability parameters.
- Government agencies and educational institutions will be a vital customer group for HCCs to target, since they add value to the construction supply chain and firms can also experiment with new technologies during the entire project lifecycle.
- Customers, firms, public and private sectors have adjusted to this changing landscape and are willing to take risks to secure a sustainable type of development, even if that means smaller projects.

With every customer segment carefully identified and a sustainable value proposition developed, HCCs will need channels to reach customers interested in sustainable orientation development. Distribution channels engage end-users in order to understand their needs and communicate them to a housing construction company. The following section introduces the distribution channels with which a HCC must connect to understand the processes and mechanisms of capturing consumer concerns within the HCI.

- **Distribution Channels (DCs)**

The participants from the study expressed their views on channels available for consumers to communicate and explain their needs and expectations from HCCs. The Saudi government public sector was noted as a special purpose vehicle on several occasions (CO1, MH2, RD1, RD2, RD3 and UN1) for achieving SDGs. Likewise, organisations leading in social services sectors, such as non-profit organisations, digital marketing companies, social media marketing companies, community marketing and green and sustainable exhibitions, conferences and road shows, were cited as channels for communicating SBMs to a mass public. For individual level engagement, participants referred to offices, company websites and personal connections as opportunistic mediums to bring HCCs closer to consumers.

Figure (5-10) and table in Appendix 9 lists the characteristics and different types of DC based on interviews with participants from the Saudi HCI.

The overall view of SBM channel development is that HCCs have become aware of sustainable marketing and distribution channels based on internet technology. As new-age consumers acquire digital experience, this is indicative of the way customer segments want to be reached and how HCCs will target them in future. As stated by MW1, "*Sustainable entrepreneurs are also using sustainable marketing methods. They are more dependent on digital marketing through social networking platforms and interact with them in a continuous way."* This view is similar to that of UN1, *"for going green, sustainable digital marketing is now an important channel as this will reduce waste of materials and time."* Therefore, digital marketing channels are emerging as strong contenders for utilisation by HCCs and hoping to find like-minded people interested in SVPs.

Until now, HCCs have used a mix of individual and mass engagement channels of distribution without thinking much on the ones that have worked well for a particular customer segment. Therefore, HCCs must have the capability to identify how each TC wants to be reached and compare this with existing methods of engaging those customers. The possibility of integrating distribution channels and identifying the ones that are cost efficient will allow HCCs to align each customer with the appropriate customer segment. In this regard, UN1 said that, *"another way to reach customers is by dedicating a team for marketing, and this team should have a connection with a green/sustainable value chain to which they can link their BM. They will be a channel for the model as a part of their social responsibility."* By creating mutual relationships, HCCs can work together with digital marketing companies to create, capture and deliver value. While the HCCs focuses on developing products that culminate in SVP for each customer segment, digital marketing partners can work on organising customers according to their housing needs and expectations.

A possible way to build strong channels is through exhibitions and conferences that bring different customer segments onto a platform shared by HCCs, risk management companies, contractors, real-estate developers, sustainability experts and other stakeholders. As CO1 said, it is necessary *"… to attend exhibitions relevant to sustainability, construction and real estate development and try to identify the target customers and their needs. Then, do an architectural model of the development with 360° virtual reality. That will be the first step to get close to the TCs and establish their views and perceptions"*. Bringing people with similar housing needs together will allow HCCs to a) understand what people want in their SVP b) develop a plan that resolves the challenges people face after occupying SVP c) allow expert teams from the capabilities on sustainable development share ideas and benefits of SVP with financial logic and d) create an appreciation among consumers that the value created by HCCs in the form of SVP is beneficial for them and for everyone engaged in the development pipeline. A similar result is echoed in previous research conducted by Bernselius & Bernselius (2019), who stated that companies implementing sustainability principles and using engagement of TCs will benefit by improving their image and advertising their reputation.

A distribution channel is capable of providing a complete view for the HCCs on TC needs, preferences, how customers can purchase specific products and services, methods of delivery of SVP and the channels available for customers post purchase. The distribution channel can also raise awareness of the company's products and services for TCs and the entire market. Therefore, HCCs will have to map out distribution channels linked with each TC, starting with raising awareness through exhibitions, government-funded conferences, websites and personal connections. This could be followed by the actions HCCs can take in explaining SVP for the targeted customers. As CO1 stated *"Also having an office that has an architectural model for the development of a special building on the site or anywhere near the development so that the future buyer can have a preliminary idea about the type of service provided and the guaranteed quality."* Once a customer segment is satisfied with the SVP, the HCCs can discuss mechanisms in place for that TC to acquire value and benefit from it. The role of the HCC in creating, delivering and capturing value must be explained to each TC as well as channels available to customers for reaching appropriate endpoints when failure occurs.

While traditional distribution channels are slowly superseded by newer methods of people engagement, people from each TC can visualise the value they are receiving. HCCs will have greater accountability with improvements in communication over social media platforms while delivering sustainable projects. Any organisation working with sustainable orientation HCCs or working on sustainable technology-driven projects will have the potential to become a distribution channel that presents HCCs focussing on sustainable development in the HCI. The availability of channels for reaching TCs from multiple markets has to be maintained by developing the kind of relationships a TC expects.

DCs, beside channelling, have another mission; that is to convey the firm's good reputation for providing sustainable products and excellent service to customers, according to their needs. The media, such as letters, post and electronic mail, text and online social network engagement, will sustain customer relationships and manage communication with partner networks in the value chain. The internet has revolutionised the way people communicate with each other. HCCs can leverage the technological advancement to their benefit by providing social and economic improvements in living conditions and greater comfort. Use of new electronic platforms offering services and products freely and with a quick turnaround time will give firms a boost in large scale residential housing projects. A summary of what a distribution channel means, as per the sample group, is given below:

- DCs are pathways that connect TCs with the firm delivering the SVP. This means governments can be regarded as DCs if providing funding for projects along with aggregating consumers from the market according to their requirements.
- Digital marketing methods are becoming increasingly attractive and sustainable for firms wishing to connect with customers, investors, suppliers and partners, as they are visible on a common platform.
- Firms use a dedicated sales team as a DC to connect with customers and understand their needs.
- Communities work effectively as a propagation mechanism for firms seeking target customers. This would also work in the case of a SBM.
- Participants find personal connections useful as a certain degree of trust exists, which makes it easier to convince and motivate people for a common cause.
- Participants also find NGOs, private/non private agencies that will be responsible for assessing the SBM and sustainability practices in the HCI with a possible DC.

A distribution channel forms an essential building block for establishing and developing customer relationships. The importance of forming customer relationships and its impact on the SBM design is discussed in the next section.

- **Customer Relationships (CR)**

The SBM design for the HCI market has been subjected to criticism relating to gathering and utilising customer views, opinions, requirements and feedbacks. The build-and-sell model has limited scope in resolving consumer concerns relating to reasonable pricing SVP. The concept and design phase of the construction timeline has few opportunities for consumers to discuss design-related issues with HCCs. During the construction phase, consumers can finally start understanding the layout, scope in design modifications or changes in material specifications; however, this provides very little opportunity for discussion or change, and is, thus, disregarded by many developers. Post-purchase timelines when HCCs enter into maintenance agreements with consumers also lacks the required trust and sustainable relationship deemed necessary. Therefore, HCCs should start identifying the type of relationships each TC expects to maintain with them. It also requires HCCs being able to list the type of relationships currently in place and the way they are integrated into the rest of the SBM. At the same time, the cost of maintaining customer relationships must be identifiable in the SBM for the HCCs. The discussion includes a wide range of CR types such as: building information centre about TCs and their preferences, future improvement, customer feedback, assistance through self-service and automated services, educating TCs abut sustainability, support through conflict centre, reliability and transparency through informing TC in process, collaboration provision, after sale relationship, from product orientation to customer orientation. Figure (5-10) and table in Appendix 10 lists the characteristics and different types of CR, based on interviews with participants from the Saudi HCI.

The CR elements of the SBM were proposed by participants CO3 and MH2 as a system that offers a unified approach to classification of customer information and preferences. Another interpretation by the developers' group was that CR is the stage where TCs can enter into working relationships with HCCs and is significantly important for the success of SBM. TCs need DCs where they can witness the structure of organisations that will provide them with products and services at reasonable prices. According to RD3, *"the change in the structure of the SBM means that there will be a customer relationship centre that will help in building a relationship with customers and keep their personal information for future development. Such an action is considered very important for the company structure and without it we would not be able to work; neither the designers nor the engineers nor the offices nor anything in the company would be working"*. Therefore, customers and housing companies are willing to take a step forward and co-create designs that work for individuals and community-based consumers. Taking customer feedback seriously and finding alternative solutions that lead to action has a profound impact on satisfaction levels and is deemed a critical success factor for HCCs (Zhao et al., 2016). As RD2 said, *"using feedback theory in the Customer Relationship element is a value added for the original BM to become a SBM."* However, relationships based solely on customer feedback must be augmented with personal assistance, self-service and automated services. In this regard, CO1 mentioned that, *"a sustainable BM is based on the customer's desire seeing that product in 360o format and decided that he wants it. Many changes in the design is one of the problems of the traditional model because the customer has no idea what will be built on the site."* The nature of relationships between consumers and HCCs can drive project and firm level strategic decisions, leading to consumer-friendly designs that emerge when HCCs can bring designers, contractors, relationship managers, suppliers and financing institutions onto a common platform.

Customer interfaces that will be developed within the Value Configuration (VC) virtual processes will allow modifications that suit end-users and improve occupancy rates. In recent years, HCCs in Saudi HCI have been unable to deliver housing facilities that exceeded customer satisfaction levels (Opoku & Abdul-Muhmin, 2010). Primarily, flexibility in construction and operational phases can give customers an idea of the modifications they want during these phases. Customer interfaces must align with the method of communication desired by a TC at any point and they must be integrated well within the SBM of a company. In this regard, MH2 said that *"the best idea here to adopt is to develop a database for customer interface where it will be shown in a website or an application. This app will ask the requirements needed and will display offers from the housing construction market. All the processes after that will be followed in the same app whenever there are any processes.*

From the beginning input in the application and waiting for contracts offers and the development of the project and finally handing the project to the owner will be tracked in the app." Tracking the type of relationships desired by a TC is a healthy start to building and managing good relationships with customers. The expectations relating to keeping up-to-date distribution channels and forming relationships while managing costs to run those channels leaves a lot to be desired.

The objective of establishing a receptive customer relationship, depending upon the distribution channels available, is to match consumer hopes with a sustainable lifestyle. Sustainability education is one of the important tasks HCCs undertake in community programs, exhibitions and conferences. Therefore, a mutually beneficial relationship can exist wherein customers benefit from SDGs that drive HCCs. As MW1 said, *"the relationship that the model* [meaning the SBM] *is aiming for is to educate customers about the nature of their future sustainable housing units."* People having gained knowledge on making investment decisions in SBM for the HCI would appreciate and trust the transparency in the activities and processes that help in developing and providing housing facilities. At times expectations can be left unfulfilled by HCCs, which make conflict resolutions a necessity for maintaining healthy relationships. According to MH2, *"One of the things that the SBM should take care of at the business level and at the country level is a special department called the conflict centre. This department is concerned with taking the views of consumers after handling the housing unit and finishing all the work. The customer after that will be asked about his/her opinion and whether he/she took what was promised in the contract. Was the model working perfectly or were there problems?"*

Maintaining a good working relationship between customers and HCCs requires developing trust in the capabilities and delivery mechanisms of the construction firm. Collaborating on design requirements sought by homeowners and incorporating them before beginning construction using new fabrication techniques can eliminate the concerns of users and provide residences that suit their needs. As MH2 described it, *"collaboration in the planning and design phase with personal assistance. The designer will be sitting with the prospective customer to translate his worries and needs to find a housing unit to suit his/her needs"*. Maintaining sustainable relationships with customers is an important element helping towards building SBMs. The type of relationship formed between customers and HCCs will a) define satisfaction levels b) internalise customers as core part of the BM and c) create a diverse group of people who take interest and pride in living sustainably. According to RD2, *"... there must be trust and confidence between you and the customer, which arises, of course, from the first meeting in the distribution channel. It must be maintained and it's important to benefit from it as much as possible"*.

Communication with customers will be largely on the VC key activities required by the SVP for the targeted TC. In this phase, HCCs can start considering the costs of construction, revenue streams and costs of maintaining distribution channels and relationships. The summery of CR is listed in the points below:

- Customer feedback is a strong element to engage them in the value chain and improve their products and services from this constant engagement over the entire project lifecycle.
- CRs work both ways, since firms can educate the customer on sustainability and maintain a sustainable relationship by making improvements based on customer feedback.
- Firms understanding the type of customer relationship it extends to each of its TS will work with a clear mindset to continue developing and building their relationship to reach new TCs.

After discussing the channels and relationship with customers, the following element is designed to show how the HCCs can build the SVP. The participants reported observations relating to the effective value configuration methods that a firm should develop for sustainable value proposition. The VC in the SBM design is in the next section.

- **Value Configuration/Key Activities (VC)**

The participants provided an interesting notion of the Value Configuration (VC) required by SVP. The value was configured into sets of predefined activities that conducted market study and analysis, selection of site, land purchasing, marketing, planning, design, construction, operational, maintenance and renovation or reuse. The next paragraph explains the need for each element of the BM to transform gradually into a SBM. The participants discussed the changes needed in their VCs and in the hierarchical structure in order to be regarded within the industry as a sustainability leader and practitioner. Focussing on their own companies, the participants comments relating to key activities are listed in figure (5-10) and table in Appendix 11.

As a SBM advocates an arrangement of firm-level activities around TC needs, VC follows the principle of sustainable design and production, bringing customers closer to the firm's sustainability agenda. According to CO2, *"what will change for activities to become sustainable will start with customer relationships, engaging and interacting with target customers in the process of developing activities while following the principles of sustainable design and sustainable production, which reduces the environmental impact and raises social satisfaction."* Organisation of activities that respects customer requirements should be a priority, following government regulations as well as principles of sustainable design and production. HCCs conducting market study and analysis will determine the demand and best locations for housing, sustainable ways to use land, type and size of housing needed by a TC, feasibility study and available partner networks that would support the project. To support inter-organisational sharing of resources and competencies in the network structure, communication and coordination should be maintained; an e-business model can be used to help supply-chain circulars as the HCCs work towards configuring value to create a SVP for each TC (Cheng et al., 2001). Sharing of resources between HCCs and partner networks can occur at any stage of VC, but this exchange is most crucial during the construction phases and the customer needs assessment phase and less so during operational and maintenance phases. The goals of the SBM that increase environmental, economic and social sustainability will be met if HCCs motivate customers to adopt innovative ideas and partner with organisations that lower net carbon emissions in construction and use of residential structures. As MH4 pointed out, *"the sustainable construction principles have not been given credible importance by HCCs leading to poor performance delivery. Failure to apply sustainable principles from the conceptual phase itself results in resource wastage. Essential commodities, like construction materials, water and energy, are consumed in far more quantities that needed"*.

The question often arising from discussions during interviews is whether a TC seeking value at the lowest prices from HCCs can be motivated to take up the sustainability agenda. This requires a careful understanding of the concept of VC, which encourages water and energy conservation and reduced use of natural resources, like timber at the forefront, while providing alternatives that are equally enticing for the TC segments. As confirmed in MH2's comments *"... implementation of innovative systems and designs' would 'reduce waste of energy and increase the life of buildings, especially as there is an increasing interest and focus on sustainable buildings with government initiatives to reduce energy consumption."* Therefore, customer involvement in HCCs' value configuration activities is critical for achieving the sustainability objectives. Stakeholder engagement is identified as an innovative BM for sustainable building by Zhao et al. (2017), and this research also proposes engagement of the TC in the VC process of the SVP.

At firm-level, identification of distribution channels is necessary so that customers can use these channels effectively and form mutually beneficial relationships. Identification of key activities forming the core business of a construction firm directed towards each SVP eventually establishes the scope of success of a project and the value capturing abilities for a firm. A HCC should be able to identify all of its internal production-related activities, problem-solving capabilities and available partner networks that are willing to support sustainable development objectives using a SBM developed by the HCCs.

Adopting the lifecycle cost analysis LCCA approach to enhance and aggregate sustainable production objectives is deemed inseparable from the SBM view. Lifecycle cost assessment calculates the running cost of internal and external activities of HCCs and their partner networks from market study and analysis through to operation and maintenance. Whether use of energy efficient products, renewable materials or management activities of a firm optimise the delivery of SVP, it is accounted as a cost incurred towards achieving SDs. According to MH1, *"the organisation is committed to dealing with the impact of its internal operations through corporate, social and environmental impacts. At the same time, the organisation makes sustainability an integral part of daily work in its process and continuously improves the socio-environmental performance of its internal and external operations. This commitment involves best practices in environmental and social* *management with a view to neutralising the global production of internal operations for any carbon emissions, and providing positive social contributions to local communities through outreach efforts"*. Every VC created by a firm to meet the housing needs of a TC should consider the consumption rates of materials included in each VC. As RD1 said, *"... key activities (means VC) will take into account that the waste produced within the site will be sold to specialised companies and recycled, which will support the revenue streams"*. In order to create sustainable VC, HCCs should adopt processes that help them identify the key activities fulfilled by a firm and its partner networks, as required in a value proposition.

A framework for assessing and documenting each step, starting from design and construction to operation and maintenance, is necessary to configure value correctly. It is also important to assess the strength of CRs and DCs provided by HCCs. As RD2 pointed out, *"... here what I want to stress is that in all activities there will be risk in every step. To mitigate that risk, we have to give it a budget and time from our timetable"*. Identifying each DC viable for reaching out to a TC with a SVP under the SBM design will allow HCCs to change and experiment with distribution channels that lead to better customer relationships. Strong CRs lead to better communication with those with expert knowledge in sustainable practices in the SVP, thus providing profitable solutions for TCs and HCCs through realignment of firm's internal activities.

VC can be understood as set of activities that can fulfil a value proposition. It is a highly resource-intensive task that is often considered indispensable, and thus fails to get much attention in terms of reuse and recycling. As MH1 points out, *"The organisation is committed to dealing with the impact of its internal operations on businesses, society and the environment. At the same time, the organisation makes sustainability an integral part of daily work in its process and continuously improves the socio-environmental performance of its internal and external operations"*. Due to the unavoidable nature of VC for creating, capturing and delivering value for each TC, it is desirable to engage in activities that increase the efficiency of processes that contribute to fulfilment of SPVs, improving distribution channels, customer relationships and revenue streams. A firm's competencies will determine the level of customer engagement with its internal processes to create value in the form of SVPs for everyone.

Firms could start with the adoption of Saudi Building Code (SBC) as a guideline for development of all its SVPs. At the same time, green suppliers must be allowed to supply firms developing projects following the SBC. This would occur only when the government stimulates the use of sustainable materials in the SBC and restricts HCCs from using sub-standard construction materials. The present challenges in reshaping a firm's VC revolves around skilling workers to follow SBC and ensuring appropriate quality control mechanisms, which HCCs have failed adopt in previous projects, are in place. As MH2 stated *"… at each stage of the key activity phase, quality control tests must take place, monitored by the beneficiary, ensuring the highest quality required, especially in the development process"*. MH2 continued, pointing out that *"As well as supervising the work process continuously; correcting and confirming the integrity of the procedures, solving problems through the establishment of an office or checker, and examining the structure of operations and sending a report to the client, the development officer must indicate any errors in the procedures"*.

The core ideas of VC changes to a SBM transformation are presented according to the response of the participants:

- HCCs that want to convert their existing BMs into SBMs will have to introduce process level changes in every activity of the organisation. Whether it is in site selection or planning and design, each activity will be driven following social, economic and environmental analysis. For example, green business models require continuous improvements to construction and processes associated with construction. However, SBM factors in social and economic parameters associated with development, which differs from the way a firm organises its activities under a green BM approach. SBMs would shape firms to meet the demands of TCs, considering their needs and ability to afford the properties they hope to purchase before alignment of the business processes. Firms with a SBM will be ready to provide quality housing with low development costs or utilisation of natural resources for consumers. However, this requires a firm to employ a workforce ready to adopt building codes and take on projects that place an impetus on sustainable development.

- A firm’s internal processes and structures are designed to provide solutions for each request made by the TCs and have resolutions available for individual needs.

- VC is wrapped around customers and not the other way around.

- Customer needs and firms’ organising capabilities are interdependent, as firms cannot sustain their business operations without addressing what customers want from the SVP.

- Continuous education on the part of customers to switch to SBMs; not because the firm’s VC is organised in that way or it can deliver mainly sustainable products profitably to customers, but because it creates sustainable and long-term value for customers while addressing their non-sustainable needs with care.

The smooth functioning of a VC depends on the firm’s capacity to provide key resources to support the firm’s activities. Interestingly, changing the value configuration has direct impact on the firm creating a transition to a SBM. Identification of sustainable resources and their availability forms a crucial part of SBMs. Estimation of resource utilisation for each VC is required to develop financial logic, realise profit and make general economic sense when undertaking construction projects.

- **Core Capabilities/Key Resources (KR)**

This was a crucial part of the firm’s ability to design a SVP since it requires experience and high knowledge of sustainability principles. Firms choose to continue building products with old proven methods of construction instead of new technologies due to lack of expertise. The adoption of low-risk approach solutions must give way to new sustainable solutions which increase experience over time. This section describes the need to identify Key Resources (KR) before taking calculated risks as a firm moves closer to sustainable practices.

Participants working for a HCC have confirmed the presence of KR within the company and its partners to address consumer requirements of housing. The need to transform a firm’s KRs relating to SVPs within the SBM view requires substantial modification in the internal structure of the organisation. HCCs have continued to work with costly yet low risk options within an industry lacking for incentives. However, in the presence of government supported projects, these firms would gradually start taking risks by trying to change internal processes, such as human resources, technological resources, IT and intellectual development. Changes in firms' KRs would directly impact VCs and the overall SVPs. The participants' responses can be seen in figure (5-10) and table in Appendix 12.

Beginning with sustainability experts, firms seeking competitive advantage in SVPs wanted specialists in sustainability. As RD1 explained, "*I want software, design, building materials, building techniques and green and sustainable building techniques.*" This section discusses the role of firms' internal and external abilities to successfully create and deliver projects that are green and socially relevant, with low upfront cost and sharing of risk throughout the project lifecycle.

HCCs are seeking sustainability experts with knowledge of developing applications both in design and implementations. Firms realise the importance of hiring expert staff members on sustainability issues as they control explicit and tacit knowledge on materials and construction methods, recycling materials and equipment, technologies and new innovations. A firm's internal capabilities would improve with the addition of knowledgeable and experienced staff. According to CO2, 'the sustainable design reduces more than 80% of environmental, social and economic impacts.' A firm's human resource, consisting of environmental experts in sustainable designs for housing, could minimise the negative impacts of the building on the environment without affecting the quality of housing. Similarly, financial experts working for the firm would take inputs from designers and contractors to estimate the cost of developing housing units. Social developers would then apply regional and cultural knowledge to approved designs by suggesting areas that improve and enhance the social attractiveness of the project. It is important to note that these activities would be the result of meetings with the TC for whom the project is being developed.

Firms seeking SBM solutions for its TCs now have the ability to benefit from BIM technical resources. TCs can view home designs virtually, which makes suggesting changes much easier to explain. Likewise, it will be easier for designers to understand the needs of consumers and to model the housing units more successfully. Therefore, DCs are necessary for the link between customer and HCCs. As BIM has brought customers to the centre of the project development process, it has become necessary to provide experts in sustainable design and construction the opportunity to explore modern and sustainable construction methods. However, CO1 argued that "*to ensure cost control and product compatibility for 3D visualisation and customer satisfaction of the product and the quality of technical capability, such as BIM. These capabilities will, of course, increase the efficiency of the model in terms of cost and efficiency. The design is seen virtually before construction. The existence of these capabilities may not be economically feasible in the case of individual or small construction projects, but in the presence of an integrated development project, these technologies must save time, be error free, in addition to reducing project waste. For example, application of BIM I is considered a turning point in the construction business because it provides the first steps towards sustainability".* In this regard, CO3 said, "*all these capabilities must be taken into consideration in the event of sustainability as these solutions reduce time, money and waste*". Sustainability experts working for a HCC or a group of companies could enhance their research and development capabilities. According to CO3, "*One advantage that I consider both important and challenging when making the change from regular BM to SBM is establishment of a specialised department in research and development (R&D) and innovation*". As a SBM encourages a SVP targeted towards a TC, experts from each department in the firm will develop a list of key resources that help fulfil the SVP. Having the capacity to develop a VP that is sustainable requires a firm to identify its physical, intellectual, human and financial resources. Whether it is the use of Information and Communication Technology (ICT) for exploring new distribution channels and enhancing customer relationships, or the identification of revenue streams (Duyshart et al., 2003) or off-site construction to reduce project waste (Pan & Goodier, 2011), the firm should be able to identify every available resource that goes towards fulfilling SVPs for any given customer group.

Accessing green supply chains that rely on locally sourced materials will reduce costs, build relationships with suppliers that keep sustainability as a high priority and achieve green certifications from the government. Supporting this view, CO2 commented, *"environmentally-friendly supply chains means we are getting the materials and equipment* *we need from environmentally-friendly suppliers or at least locally. They are well-known in the market, their policy is clear and they have green certificates. Working with this green network strengthens the essence of our sustainable and environmentally-friendly business by connecting with other green networks in the market and marketing to us in this regard"*. The limited nature of materials regulates costs of construction, which provides an incentive for application of renewable energy, recycled materials and water to constitute a significant part of the resources that go into a housing project. The organisational resources of a HCC must come together in discussion with customers from each segment to delineate the processes that will contribute to addressing the concerns of the TC. The ways in which HCCs fulfil the SVP needs of customers using its internal and external resources can be concealed. However, implementation of SDGs in the HCI can be achieved if all parties are willing and committed to support the firm's endeavour to transfer to a SBM. As CO1 mentioned, *"It is certain that in the transition to a SBM, you need commitment and the willingness of all parties"*. When firms can engage sustainability-driven customers, experts, suppliers, developers and contractors, this creates an incentive for the government to participate in such projects, providing access to sustainable sites. Sharing the risk of development with the use of LCCA management concepts and certifications from environmentally-approved institutions will make business cases for the SBM and enhance value and achieve profitability.

A firm seeking to transition towards a SBM will eventually have to create an environment that seeks sustainable solutions in every action, process or activity. It is the firm's internal KRs and external partnerships that allow it to create value, deliver it sustainably and realise profits in the processes that are shared equally by customers, firms and government in some situations. As RD2 stated, *"Manufacturers of housing construction materials need to develop strong relationships with SBMs partners. This formidable relationship must align according to the movement of value creation for customers and participating firms"*. Therefore, collaboration and support of the HCI to operate in specialised markets and produce local raw materials such as concrete and block while supporting the green value chain is required.

Tracking the cost of goods used in construction and its price volatility is a challenge for cost estimation experts. Firms seeking to maximise value must engage likeminded customers, suppliers, government agencies and experts. As RD2 said, *"Predicting risks and what will happen in the market is important. Before we start the project and during construction, we have to assess and predict risks"*. Risk management is a critical component of a firm's competence to successfully deliver projects.

The participants' responses on KRs that allow firms to create value can be summed up as:

- HCCs targeting SBM transformation could map the KRs needed to serve a SVP. It was able to identify the DCs that link up to the firm and create strong relationships with suppliers and customers. HCC adopting the SBM approach would have retained some of their previous KRs, combining them with activities such as use of technology in design, construction methods and customer relationship management.

- The role of employees, experts and workers in supporting a SBM is integral to the successful delivery of SVP. HCCs need to support and foster evolution and innovation capabilities that may be realised through engagement.

- Hiring the right human KR is the first step to achieving a SBM since it will impact other areas of a HCC's competence, such as securing support from the government, software development, sourcing physical resources from green supply chains and developing the intellectual capital of the firm in the form of patents, designs and copyrights.

- The functioning of the HCC as a tightly coupled unit with timely communication of requirements from the customer to the designer and so on will lead to better results.

- Transitioning into a HCC competent of delivering SVP in the HCI with social benefits was regarded as an important resource to acquire. This KR would be targeted by the community when the model improved on efficiency.

- HCCs could start by making internal changes, such as employing sustainability experts to educate, reform and direct senior management on issues of sustainable practices. The HCC would attend to the directives of sustainability experts and bring changes to the company and the type of project it selected. Sustainability experts would guide the cost calculations and justify revenue logic. They would be responsible for finding environmental studies, innovative yet safe architectural designs and safe construction methods to support the cause and promote uptake of the SBM.

- HCCs that foray into SBM could be easily distinguished from their counterparts. Their low socio-environmental brand would speak to its customers by itself as the firm proves to be an efficient service provider, solving the problems customers face with existing housing models.

Having reviewed the KRs required by HCCs transitioning to SBMs, it is important to understand the role of partner networks in fulfilling the firms' sustainability goals. The next section reports on the participants' views of the processes and activities involved in identifying partner networks and suppliers and the motivations behind those partnerships.

- **Partner Networks (PN)**

Partnership Networks (PN) are comprised of public and private organisations. HCC can partner with manufacturers of equipment and construction material suppliers. They could also partner with likeminded businesses, financial organisations for investment in housing projects, development funding organisations, banks, media services, professional institutions and even non-government organisations. Therefore, PNs are a set of entities that enhance firms' VC & KR and overlook the process of development based on contributions made in all areas of the SBM. The participants recognised the importance of sustainable PNs support firms developing SVPs. PNs drastically improve the capabilities of a firm as they provide added knowledge and resources for developing SVPs and transforming a BM to a sustainable one. The list of PNs that the participants were confident about are listed in figure (5-10) and table in Appendix 13.

HCCs capable of delivering conventional VPs are met with the challenge of serving the needs of customer segments lying outside the delivery of their current BM. As seen with the

KR element, firms that want to work on a SBM would have traditional capabilities in addition to sustainable ones. In this regard, sustainable HCC would still have partners that used or supported traditional methods to survive in the HCI.

Firms have been unable to create sustainable partnerships with networks to deliver projects that follow the 3BL approach (Mokhlesian & Holmén, 2012). Therefore, HCCs are constantly in search for partners or collaborators. PNs could consist of companies within their supply chain that include companies starting from extraction of raw materials to disposal of construction debris. In the study, participants could identify organisations that were capable of increasing the competence of HCCs by entering the supply chain as and when required. This section describes the role and nature of partnering firms to help parent firms create and deliver SVPs.

A HCC benefits from the services of a partnering company from the start of customer engagement programs. These companies allow the parent firm to take lead role in defining the time and place of intervention of partner networks in their SBM and the time of their exit. A timeline-based intervention by PNs allows waste reduction, less errors in design and delivery structure. According to CO3, *"... partners have two advantages for a SBM; to take the service/equipment/materials you want without financial payment and without financially exhausting the BM; secondly to reduce employment and maintain efficiency"*. Partnerships that jeopardise the sustainability of the HCI by encouraging unplanned use of land should be dealt with in a timely manner. In this regard, RD1 said that *"partnership between the national housing programs and the private sector exists but there are problems in understanding this partnership. The developer of a residential project is forced to donate the services and facilities for the ministries to set up their projects, but the problem is that they do not do so at the start of the project"*. Before partnering with public institutions, it is necessary that the financial cost of development is made available according to delivery schedules to avoid delay in development of essential social infrastructures, such as mosques, schools, hospitals and commercial buildings. RD1 and RD2 were of the view that *"in the case of partnership with the public sector, the country can bargain with the developer so that they develop and build mosques and schools in housing developments and in return they* *give them grants by increasing the number of floors and building percentage. Especially if the development plans for the city are in-high density areas at the borders of the city".*

Partnering with manufacturers of equipment and construction materials and suppliers that can supply materials and equipment according to project schedules at a fixed price reduces the stress on project budgets. It also allows partnering suppliers to predict their delivery schedules and, in turn, manage their supply chains more effectively. When a HCC or a single investor is responsible for financial payments for the entire BM, it could destroy its financial assets if it tried to develop using a sustainable material, such as precast, which produces less waste and is environmentally sustainable but requires upfront payments to precast manufacturers. CO1 gives an example in this situation; for example, *"… if I did the precast concrete alone, I would break down my BM revenues and financial assets. There should be a strategic partnership with the suppliers of precast and concrete so that they develop and secure the concrete product whenever it is requested and at a reduced price because a unified production line is guaranteed, therefore the partnership would be built on a good, long-term relationship".* Therefore, precast suppliers should be incentivised by the project investors to secure a steady supply of construction material for industrial scale housing development, possibly located on a small-scale off-site factory.

The general view observed during discussion on current state of PNs in the Saudi HCI was that HCCs with SBM as their main agenda had started developing relationships with green building material suppliers, waste management and disposal companies, customer relationship management companies and firms that market sustainability in public gatherings. This shift towards companies that use innovative processes in their service delivery is driven from a) pressures to compete in mature markets amongst competitors and b) increasing cost of raw materials due to climate change. The key motivation for partnerships, according to the interviewees, indicates a growing need to optimise the SBMs process for a growing population, reduce risk and uncertainty and acquire the key resources and activities of partnering companies.

From the perspective of transforming BMs into SBMs, it is important to know who the key PNs and suppliers are and what resources they provide for the parent HCC of the SBM. It is also important to know what key activities a partner provides. Having this knowledge of the parent firm is crucial to drive SBM efforts. Participants reported that partnering with businesses having similar orientation will lead to an increase in market value as their knowledge of product design will increase safety and lower production waste. According to CO1, *"partnerships with clean energy companies will be one of the best partnerships and should work from the initiation phase to ensure that the products are environmentally sound, with thermal insulation and energy-saving features"*. Like-minded companies have the tendency to look out for each other as the existence of one depends on the survival and success of the other. HCCs that are able to define their VCs based on their KRs and support from sustainability-driven PNs are able to measure their revenue model accurately, thus taking the project further away from risk and uncertainty.

HCC can seek partnerships with credible investors, real-estate development companies, media companies and bankers providing loans for social responsibility programs. In this regard, RD3 mentioned that *"partnerships with banks through their social participation in support of sustainable development in the country and as strategic partners make their participation in the community loved and supported"*. One of the key objectives in partnering for a SBM is to increase communication and integration between designers, contractors and investors. Strategic decisions can be taken if designers of the SBM are able to create solutions for TCs on the table that are at once reviewed by contractors. HCCs will develop their SBM keeping a record of PNs that include sustainability practices in their products and services. It is essential that partnering with Non-Government Organisations (NGOs) that review the processes and activities of construction firms and partnering networks are used as a medium for marketing the SBM in the residential markets and the industry.

The role of PN is to surround the parent model and help to sustain its business operations. It is up to the parent model to confront TC needs with tangible solutions supported by its PN to achieve sustainable competitive advantage. Whether partnering with technology partners, certified contractors, authorities dealing with real-estate projects or any other agency, it is necessary that the firm responsible for its customers' needs are able to achieve mutually permissible solutions through the existence of a reliable network.

The impact of a solid PN may increase SBM outcomes, thus incentivising the supply chain side. Educational institutions were seen as a viable opportunity for developers to increase awareness in the society of sustainability and SBMs. Increased exposure would automatically raise the value of SBMs and attract more customers. Similarly, educational and professional institutions would lend their expert advice and knowledge to improve the designs that went into its project lifecycle, therefore enhancing the firm's overall knowledge of the SBM. According to RD1 "*universities here can enter into a partnership with this SBM, either by providing their expertise or by training qualified students and researchers specialising in sustainability*". They could also advise development organisations by building prototypes and design-based solutions, according to their needs.

Sustainability assessment professionals would become vital when working towards sustainability because Saudi Arabia lacks development of sustainability standards or a performance-based system that gives credit to suppliers of sustainable products. According to RD1, *"if we have sustainability assessors or an organisation in the country that can assess and evaluate sustainable business or products and give ratings applicable to this country rather than the international ones, partnership with such organisations will enhance the work for the company and the assessors will work as a marketing channel and promote and advertise the excellent work, but that would need strategic partnerships with clear controls"*. RD1 also suggested that, "*sustainable model partners and allies should be placed in the company's structure, as they would increase the value of the BM through their reputation and position in the market"*. The findings from the discussions are summarised below:

- Organisations willing to provide supporting roles for parent SBMs through supply chain partnerships is necessary for development as well as knowing how well they perform their activities and the resources needed by those firms.

- PNs must be aligned with parent SBMs for issues of sustainable development.

- HCCs need to determine the role of the partnering firm and a time plan for commencement of its engagement in the project lifecycle and a scheduled time of exit. This will create accountability and help deliver projects on time. Customer-oriented design and use of high-quality materials must be incorporated in the construction process.

- Partnering with likeminded organisations and ensuring equal sharing of profits between customers, HCCs and partnering firms, creates harmony in the industry as all organisations benefit before, during and after the project development process.

- Partnering capabilities are increased if organisational interfaces are simplified and user-friendly for efficient exchange of information between partnering firms and the developing company.

As partners of a HCC can significantly enhance its capabilities, the way a firm aligns itself and its resources creates the cost structure of the project. Until now, the SVP targeting a TC is dependent on the firm's capabilities and the support of its PNs in meeting the VP. The structure of costs for developing the product is essential and thus forms a critical part of SBM transformation. This is discussed in the next section.

- **Cost Structure (CS)**

Cost Structure (CS) is a detailed description of the most important costs inherent in the SBM. It identifies the key most expensive and time-consuming resources and activities. According to the participants, project lifecycle costs revolve around variable costs, such as materials, equipment, labour and fixed costs, such as marketing, staff salaries, utilities and maintenance costs. These costs were identified from the perspective of participants as costs important for the functioning of the business. Accurate cost estimates were, in many ways, seen as indications of business strengths and challenges. These are listed in figure (5-10) and table Appendix 14. The participants and their responses on cost structures are reviewed in the following section.

In the words of MW1, *"The heaviest costs in the model are for infrastructure, workers, construction, electricity and sewage, as they consume more than half of the total cost"*. Consequently, a HCC could understand its existing BM based on cost structure. An example of a cost-driven BM is a lean cost structure and low-price value proposition, whereas value-driven BMs are focussed on value creation and working towards a premium value proposition.

According to CO1, *"in cost structure, the change to a SBM means that we should plan the project in equal phases in term of time and money. For example, studies, design costs, construction costs, renovation and reusing costs, operating costs and maintenance costs. All these stages would have a similar time and budget to avoid risks."* From a SBM transformation perspective, sustainability should be a part of every activity involved in the project lifecycle, resulting in a significant cost burden for the builder. As green construction activities require radically different capabilities and resources, which are cost overheads for the developer, they must share this cost with their partner networks comprising green supply chain manufacturers and SBM investors. Sharing of financial costs during and after the construction lifecycle allows reduced high upfront costs having to be paid by consumers for SVPs. Likewise, a drop in financial stress allows developers to pay attention to social infrastructure, which is neglected in public housing programs due to shortage of capital.

A BM helps firms estimate costs for many activities associated with the project lifecycle. Whether it is media and marketing costs for organising exhibitions, participating in sustainability campaigns or shows, it consumes a large chunk of fixed costs associated with the project. As CO1 said, *".... fourth quarter of the project budget goes for marketing as they are campaigning for our products and also organise models and attend exhibitions to display, sell and rent our products."* The supply side of construction and the demand side; i.e., customers, are equally concerned with marketing and R&D costs, which are substantial for sustainable projects initially. Applying for sustainability performance certifications can add an overhead for the developers. However, this upfront cost is a better investment as it attracts sustainability-driven TCs seeking assurances about the development processes used in construction. In this regard, RD4 mentioned the increasing role of technological investments and support costs stating that, "*conventional BM projects differ from sustainable in that use of different technologies will be widespread in the SBM elements. In the outputs of this model, such as SVP, we will have a reduction in the costs of normal operations from construction and supply of materials and labour. There will be an increase in the costs of technical support, research and development, studies and design."* The firms with SBM have to be comfortable in dealing with higher upfront costs and long-term profitability. Thus, partner networks can support these roles through financial support, such as loans, and technological support by renting equipment and machinery.

TCs seeking lower upfront costs have no interest in orchestrating SVP activities as increased environmental orientation can reduce running costs but seek an increase in short-term costs. Seeking financial assistance from customers when they cannot understand the low-level details of SVP or see the changes can be difficult for a HCC to justify. However, educating the customer on the benefits of socio-environmental performance, three-dimensional modelling of the SVP and signed maintenance and operation agreements, would improve customer confidence.

As CO2 said, *"when we talk and display sustainable products as a summary of our SBM, we mean the product is sustainable in every step that has been taken, such as the design, process of production, maintenance, efficiency, operation or even renovation of an existing building. This will come at a price. There will be extra costs for the materials used for this product, but with time this amount of money is payable for the quality and the environment."* Therefore, cost structure for a SBM will identify the most important costs associated with the project lifecycle activities, starting from design and conceptualisation to operation and maintenance. Noting that the activities that are most expensive will be largely for the technological frontier and use of building materials from locally produced green supply chains. Knowing whether the HCC is inclined towards cost-driven VPs or SVP is important for the success and delivery. A clear understanding of the cost structure, based on different stages of development and identified as fixed or variable costs as well as the people and partners behind those investments, would help secure the delivery of the SVP to its intended buyers. According to MW1, *"the factors that affect the cost structure include the local supply. Local construction prices are expensive. Thus, the option to import would include consideration of time required for transportation and supply. This also represents a financial burden on companies. The lack of local companies producing sustainable building materials and providing a sustainable service to HCCs is a problem, as it is added to the cost structure of the sustainable projects as we are forced to import these materials from abroad"*.

Cost of infrastructure maintenance is considered high compared with infrastructure development costs, and they receive less attention as those costs are spread out over a period of several years. Supporting green facilities can be resourced and cost-intensive if not maintained properly. Similarly, the cost of transportation of distribution of the products and increase in long-term projects. Project timelines in SBM should be designed accordingly. CR platforms and interfacing costs are initially higher with the adoption of technology, but with time go down due to economies of scale. The views presented with reference to improving cost structure as a regulating mechanism to take decisions and direct the management towards sustainable designs, marketing methods, partnering, construction techniques, technological innovations and so on, are summarised in the points below:

- HCC that want to understand their BMs should look at their cost structure to know the value delivery model and the TC to whom they provide products and services.
- To develop a cost structure, a HCC should look at its VCs, KRs and PNs, which help the firm to market its products, pay for innovations in technology and R&D, receive certifications for adoption of green and sustainable construction activities and processes, sourcing machineries, materials, setting infrastructure maintenance contracts, training costs, facilities cost, transportation and logistical payments.
- HCC and project level processes that follow sustainability principles have higher short-term costs that are recovered over time, as they generally require less maintenance than traditional methods.
- A HCC seeking to benefit from a SBM must think strategically, acquire sustainable technologies and develop PNs with public and private institutions to reduce risks associated with development.

Once a business can structure the financial inflow and outflow, it can make decisions about working with sustainability driven partners instead of traditional companies. The management can choose to adopt expensive processes, machinery, technology and equipment based on SBM ideas and innovations to replace lower priced traditional methods based on the risk portfolio of the project at a given time. However, understanding the basics of costs incurred and the state of financial stability is crucial for HCCs at any point, but more importantly before the process of VCs and KRs. Thus, SBMs transformation require knowledge of the characteristics of the TCs and the proposed SVPs to estimate the CSs and thus decide on the VCs and KRs required to reach the revenue model. The revenue model is described in the next section.

- **Revenue Model (RM)**

The Revenue Model (RM) is a summarised version of the CSs that combine to fulfil a SVP. The firm identifies and lists the benefits to its TCs. noting every aspect in which measurable value has been created. It also lists the benefits extended via its activities with partnering networks. Therefore, the RM is a summary of all the benefits offered by a HCC in its SVP to meet a customer's requirements while generating a profit for itself along with benefits for its stakeholders. The RM is the backbone of all construction activities and motivates HCCs to transform traditional BMs into SBMs. The common themes in financial logic, as depicted by the participants, are given in figure (5-10) and table in appendix 15. The response of participants in relation to improving the RM to make the SBM a priority is discussed in the following section.

To develop an accurate RM, HCC have been asked to consider the value for which customers are willing to pay. According to the participants, this meant looking at VPs that TCs were currently paying, payment methods and preferred payment options for buying housing unities. For businesses operating in the HCI, understanding their RM required knowing how much each revenue stream contributed to the overall revenue. Participants believed that the value capture model and the direction developers took in creating new value. which followed economic, environmental and social sustainability principles, set the tone for generation of new revenue. The multiple ways of achieving financial profitability from sustainable revenue streams are described in the following sections.

The perception of losing profit by applying environmental measures during the design and development stage is the main potential problem for adopting sustainability, primarily because customers are unwilling or unable to pay for more advanced solutions (Mokhlesian & Holmén, 2012). Therefore, if customers cannot afford SVP, it causes the collapse of the firms promoting the SBM. The role of the government as a state actor supporting sustainable development comes into play. Government compensation is for those for whom affordability is the only concern, i.e., TCs who want SVP and realise its benefits, but are unable to purchase them due to an income-affordability gap. According to CO1, *"support from the public sectors in the state that accept responsibility for promoting sustainability may be in the form of grants or sometimes logistics."* For the government, this is a healthy environment since it is able to a) develop a sustainable HCI backed by the national financial reserves b) meet climate and renewable energy commitments in accordance with international summits c) develop support for industries, such as promoting a knowledgeable labour force, skilled in sustainability practices and renewable energy d) lower energy requirements arising from housing a growing population e) receive support for sustainability practice from international financial investors, multinational corporations and globally accredited sustainable development institutions to support projects, technologies and share their experience. In this regard, CS1 said that, *"the government took a positive approach in 2016 to formulating a sustainable vision for the future of the national economy, which involves bringing together ministries to work together. It is time for companies and their leaders to bring together their teams and constituencies to promote comprehensive and sustainable development aimed at securing their future. As reported, the government will support sustainable business and any business that supports the goals of sustainable development"*. To understand the need to develop a SBM is to realise the transformative nature of moving from the traditional BM of housing projects that use large amounts of materials, energy and water, to less waste generating, energy efficient SBM structures.

In recent years, critics of social and environmental sustainability have found little incentive to invest in sustainable practices in the HCI as they have paid a premium price for housing with publicly-shared spaces over which they have had little or no control. This was the case in particular with Saudi HCI, as the HCCs had developed housing with large open spaces for development but, due to lack of sales in sustainable HCI projects that demanded a high premium, the firms were unable to construct the planned social infrastructure. This resulted in failure to deliver the VP and generate revenue streams. MM1 explained, *"including sustainability and green architecture in the model (means SBM), returns are environmental, support the principle of life quality and provide services to the development, such as green* *spaces, playground facilities, parks and places for people to gather and communicate"*. In such situations, where customers cannot understand the full potential of social and environmental sustainability benefits, HCCs can develop relationships with PNs that acknowledge this value and provide sustainable revenue streams for its generation and maintenance (for example, parking facilities, convenience stores, medical facilities, etc.), thus relieving the consumer from this financial burden. HCC must also educate the public through social and environmental sustainability programs as the firms' revenue streams will be spread over long-term partnerships with consumers.

HCC can generate revenue streams from financial capital invested in sustainability projects in the Saudi HCI (Asif, 2016). As solar energy is becoming accessible and cost is comparable with non-renewables for the end user in the value chain, HCCs setting up solar farms around residential housing areas early in the project lifecycle would generate enough energy to support construction activities. According to RD1, *"there is a chance in getting returns from the stages of value creation; for example, returns from the project's solar energy supply"*. Returns may come from the services and utilities in the project, or through use of less expensive recycling materials; and these sources provide infinite income. In essence, each stage of production will start generating revenue for the HCC and its partners.

RD3 argues, *"when a HCC spends from its own capital on technological resources and implements value engineering or lifecycle costing analysis for a residential project, and saves money through resource efficiency, it continues to sell the products at the same prices. As the technology helps the HCC to develop quality homes with durable products at the same prices and the increase in sales generates further growth in market shares, these profits should be pumped back to equalise the revenue model and prove sustainability of the SBM revenue streams"*. The initial reserves used by HCCs to compete in the sustainability market will play a vital role in developing competitive advantage in this industry (Abdelkafi and Täuscher, 2016, Schaltegger et al. 2011, and Zott and Amit, 2014). However, the methods a HCC has initially thought of to generate revenue streams from sale of housing units would have to convert into partnerships with customers, investors and stage-wise revenue generation capabilities. The firms must begin by looking at revenue arising from multiple streams within a single project delivery. As CO3 said, *"in developing a large housing* *development project we waive the financial costs of the design and in return we own property in the project as an investment in a long-term profit model"*. The design, modelling and marketing activities for seeking investment in large-scale projects is at risk until the HCC has brought in all the investors to develop the project. These activities have caused a major financial drain for HCCs with limited marketing budgets.

HCCs can generate RMs from direct sale of assets, usage fees, leasing out space, licensing and advertising. Fixed prices for SVPs are generated depending on the TCs and volume of development. Prices are regulated according to product features, or dynamically allocated depending on bargaining and real-time market prices. Therefore, it is crucial, as a developing firm, to know more about what customers, investors, governments and private companies are willing to pay and whether engaging in this type of development would contribute to the HCC's overall RM.

As mentioned earlier, green loans will provide the necessary support from government institutions, non-government and not-for-profit organisations to develop, assess and certify sustainably-built infrastructure. The Saudi government, in late 2019, offered incentives of 28 Million US dollars to support renewable energy practices (Nereim, 2019). In this view CO1 predict such a transition saying, *"In the future there will be support from the government, institutions and non-governmental organisations in an assortment of green loans, particularly those related to renewable resources and sustainability, as the country is working to achieve the Saudi Vision 2030 and SDGs 2030 implementation. This support should be placed in the revenue structure"*. As consumers become increasingly aware of the rising costs of natural resources, incentives should be made available to develop technologies that use less material while maintaining the benchmarks of safety.

Adding services to product revenues is another way to realise profits. In the Saudi HCI developers can develop a residential project and sell the entire project for only a small profit. However, the HCC could keep small spaces within the project to earn revenue from services provided on that piece of land. Therefore, the role of the developer would essentially change to become a service provider and benefit from maintenance operations that provide a source of continuous income. As less material or recycled material is used, there is reduced waste in the VC process, which becomes a source of savings when compared with traditional BMs. Such innovations that radically impact the HCI will, in turn, become a viable revenue stream as competitors will want to use them to sustain their projects. CO3 mentioned, *"... I also think that through R&D and innovation we can generate a new source of income not found in the traditional BM. For example, income will be money in exchange for courses or consulting for emerging companies"*.

Findings relating to sources of RM in a SBM are summarised below:

- The revenue stream of a SBM identifies the value for which a person, institution or agency would pay. It also defines the current payment methods or equivalent value being paid to acquire that newly-created value. Revenue streams identify the payment options a customer finds comfortable and how this affects the overall revenue stream of the selling firm.

- At present, government institutions are willing to compensate HCCs for the value customers are receiving. This is partly because the Saudi Government is motivated to pursue a socio-economic and environmental agenda. This also allows the government to negotiate pricing, benefit from large volume housing and earn revenue from its long-term use.

- The social and environmental benefits generated in the SBM provide the motivation to think and move towards a SVP. As the revenue in a SBM is not always physical but may be social, it is this vital requirement that serves as the life-support for long-term payback and profitability.

- Revenue streams must be realised from multiple channels over a period of time. The aim of resource efficiency, swapping, market share growth, consulting, proprietary technology, innovation capabilities or adding services to product revenues, is to achieve a clear and logical flow of financial capital, which serves as the funding mechanism for present and future projects.

The results show clearly why each HCC has tried to understand its SBM elements in detail because they are highly influential in giving direction to business management. BM elements and their role in steering VP to fulfilment with the support of other elements makes SBM credible in approach. The elements strengthen the overall concept and design of a SBM. Top management professionals could use the structured approach that SBMs offer to guide their firms towards sustainable production in the HCI. Although, SBM thinking would encounter numerous challenges from people who oppose change but resolving internal and external conflicts would be easier if management followed the tenets of sustainable construction and development. SBMs are best understood in the context of its elements and how they connect and support business functions without affecting economic, environmental and social dimensions. This was identified in the interviews and results of the study. The participants explicitly highlighted through examples the BM elements and their importance in the project lifecycle. Examining the nature of relationships among SBM elements requires another method of analysis. For this purpose, ISM is selected to discover the mutual relationships between SBM elements. This approach helps in finding the critical elements that are more important hence needing greater attention from the management. More details are given in the next chapter (chapter 6). The next section discusses change required by HCCs to achieve transformation into a SBM.

5.4.4 Changes related to the transformation to SBM in the HCI

Participants were asked about changes that could be cooperative while implementing SBM in the HCI. This allowed the participants to capture any similar characteristics applicable across HCCs. The ideas put forward by participants in interviews were combined into six sub-themes: awareness, alter goals and dominate mind set, political change, value chain upgrade, media and education support, engagement and collaboration with public. Overall, these six sub-themes of change are what participants thought was needed to become more sustainable as a HCC, government organisation, non-government stakeholder and TC. It allowed participants to capture any value creation opportunity and benefit from it during the project lifecycle. The participants in the study shared a deep understanding of the problems and issues associated with housing in general and the change drivers that could help HCC progress towards sustainability in the HCI. Participants' experience in the HCI varied from real estate developers and contractors to CEO and CFO of reputable organisations in Saudi Arabia. Their firms are actively pursuing projects on housing construction, development and policymaking in the country. The changes needed to adopt a more sustainable approach in HCCs and society in a broader sense are demonstrated in figures (5-11 & 5-12). All these main categories of changes are reviewed and described in the following subsections.

Name	Sources	Referen...	Created On	Created...	Modified On
SBM Definition	19	35	8/9/18, 1:25 PM	ADNAN	Today, 2:50 PM
Benefits of SBM	0	0	9/10/18, 12:32 PM	ADNAN	11/23/18, 1:17 AM
Challenges SBM	0	0	9/2/18, 3:52 AM	ADNAN	11/22/18, 10:33 PM
Changes for the SBM	0	0	8/19/18, 4:51 PM	ADNAN	Today, 3:38 PM
Awarness	22	36	Today, 3:07 PM	ADNAN	Today, 3:33 PM
Alter Goals & Dominate Mind-set	17	21	Today, 2:58 PM	ADNAN	Today, 3:33 PM
Political Changes	10	13	Today, 2:57 PM	ADNAN	Today, 3:33 PM
Upgrade Value Chain	8	9	Today, 3:08 PM	ADNAN	Today, 3:33 PM
Media & Education Support	6	8	Today, 3:09 PM	ADNAN	Today, 3:33 PM
Engagment and Collaboration with the Public	5	5	Today, 3:09 PM	ADNAN	Today, 3:34 PM

Fig 5-11: Changes related to transformation to SBM in a hierarchy based on participants' responses

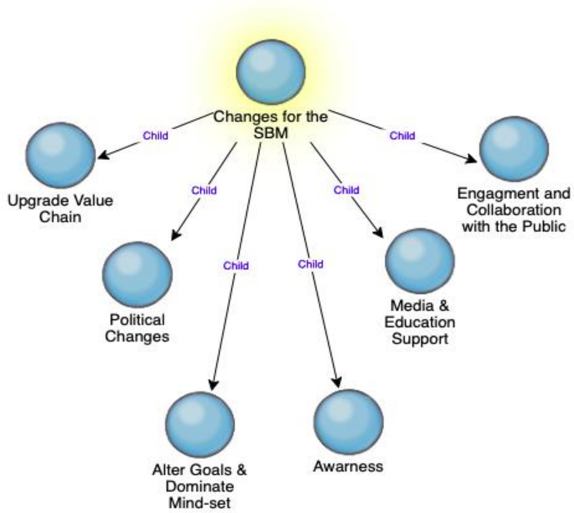

Fig 5-12: SBM Changes Nodes

- **Awareness**

The speed with which information reaches the public has improved over the past years. Spread of the internet has enabled technologies and development of communications infrastructure to be attributed to quick dissemination of information. Mobile devices allow people to access news, share and exchange information in real time, making this age the most advanced and complex in history. However, awareness of the consumption habits of people in Saudi Arabia and the rate at which the global population is consuming natural resources has been recently acknowledged. In this respect, the participants from the HCI considered internet communication channels a valid instrument for awareness initiatives for sustainable development.

The increasing use of technology has allowed people to have information at their fingertips. Consumers interested in new housing model can review projects throughout the project lifecycle due to ICT adoption by the SBM. On the other hand, HCCs can reach out to new TC with greater ease due to digital marketing methods costing less than methods used previously. Based on participants' responses during interviews, they found the quality and number of DCs had improved over the past decade. Large-scale housing businesses were targeted by some participants for failure to generate adequate interest among TCs on sensitive environmental issues. Despite the consequences of unsustainable BMs becoming evident, participants were unable to change the macroeconomic conditions of the society where they exist. One of the concerns raised by CO1 was that there were limited DC and CRs for awareness of sustainability as a concept. The lack of awareness about sustainability practices was witnessed at firm level as well as in the entire business ecosystem. On this matter, CO1 said, "*What I see is that it will be hard for any business to be sustainable if the business environment is not ready or not sustainable*". Therefore, HCCs' abilities to deliver sustainable products rely intrinsically on the transformation of internal and external business environments.

As RD1 pointed out, "*One of the most important technological changes in the potential for transformation to a SBM is the use of modern construction techniques, especially green ones, such as offsite and automated building systems to preserve financial, environmental and temporal waste, as well as use of modern, quality, green construction materials, and communication and communication technologies*". Therefore, changing awareness levels of HCCs and adopting new technologies must be met with an equal demand for SBMs. For this purpose, awareness among consumers should be raised using a diverse range of marketing channels.

The demand for SBMs, according to some participants, indicated that the average consumer was not aware of the total benefits of sustainable practices. Factors that transform a traditional BM for a residential project into a socio-environmental BM have not been marketed effectively. Participants were worried about pushing sustainability agendas in large-scale projects as they could lose customers because SVPs continue to demand a premium price. On the other hand, there has been little appreciation for social and environmental factors in government-funded projects that sustainable firms have painstakingly integrated into residential projects.

As RD4 mentioned, "… *difficulties that the HCC usually faces include appreciation of sustainable products by government departments. I think it is a matter of awareness and, consequently, the mentality and culture in which the activities of governmental and private organisations are managed must be changed*". For example, projects requiring environmental study should be completed in a time-bound manner, but the necessary standards required for the development of that project to proceed in a safe and sustainable manner are missing. CO1 presents a similar view of creation of awareness of sustainable practices in the community and across the HCI. Government subsidies for sustainable projects with incentives linked to long-term payoff for the buyer is one way to generate awareness in markets.

In conclusion, consumer awareness is a multi-faceted problem that needs immediate attention. Creating an open and transparent environment for HCCs to communicate with TCs on environmental issues is required. Likewise, the government must allow HCC seeking SBM to flourish by supporting them and bringing consumers and HCCs together through their interface or special programs.

- **Alter Goals & Dominate Mind-sets**

Setting the right goals from the start is considered an important factor of success in SBMs. Delivering SVP at the lowest possible price and considering socio-environmental benefits was seen as an ideal business opportunity by the participants. Long-term goals include wellbeing of the environment as a primary objective along with consumer satisfaction. In this regard, participants envisioned altering their firms' goals and working with a dominant frame of mind, as portrayed in their business activities.

When HCC have to choose between financial loss and environmental damage, many would be inclined towards securing financial revenue. However, this could be changed if business owners in the HCI took a clear stand on such issues and developed a culture of finding alternate solutions that would not cause a significant drain on wealth across any dimension of sustainability. Change within the HCC and its realignment could facilitate development of people that value sustainability and promote this concept at all organisational levels. As CO1 put it, *"it is certain that in the transition to a SBM, you need commitment and the will of all parties to transform to a SBM"*.

The success of the SBM depends as much on the internal transformation of the business as on external environmental factors, such as government support for generating consumer awareness. The culmination of organisational-level changes combined with government support for sustainable projects can lead to healthy environmental, economic and social action plan development.

- **Political Changes**

According to real-estate professionals, governments should intervene in the proceedings of private housing developers and contractors to restrict wastefulness of resources, which results from unsustainable BMs in the HCI. This will slowly promote the uptake of SBMs among all housing development businesses. The Ministry of Housing can also create a supportive environment for SBM firms to enter into PPP by growing their sustainable project portfolio.

In this regard, real estate developers reported their view on the existing state of national housing policy and the government's approach in making policies for development and construction of houses. As RD1 mentions, *"housing market is fragmented and after waiting for many years it is apparent that current housing policy is failing to fix it."* Thus, it can be said that developers seeking sustainability find the current national housing policy unsupportive of their goals as providers of green solutions in social community developments over the course of the projects. Therefore, it was important for real estate developers, such as RD1, to examine the external environment in terms of policies, laws and overall support of the public housing sector to direct their business towards SBM.

Political change could be achieved when the government supports the SBMs in its policymaking process, making procurement, certification and financing easier, open and transparent. HCC must realise that their existing BM activities would not survive market conditions as climate change affects critical areas of development, such as energy, water and construction materials. The looming environmental threat must change government institutions into supporters of SDs and demonstrate high levels of proficiency and experience. Examining the HCC's VCs, RDI commented, *"key activities, also planning and design, must be based on the existing requirements and regulations of both customers and government. Nothing should be done without clear permissions and, as far as possible, predict possible future changes"*.

In conclusion, political changes in support of the implementation of the SBM in the HCI would accelerate HCC' uptake of sustainable practices. Policymakers can engage environmental researchers by supporting their research. The MOH can hire experts to develop standards for waste management, energy efficiency and environmental impact assessment. These standards would be implemented in a phased manner and would apply to all industries engaged in construction supply chains, thus helping them transition over time towards SBMs.

- **Value Chain Upgrades**

For firms engaged in HCI, turning to sustainability meant upgrading their value chains. Participants highlighted the importance of accessing global green material suppliers to meet world sustainability standards and create the conditions necessary for generating more revenue through economic upgrading. However, this inclusive growth would require understanding sustainability in all its dimensions – economic, environmental and social. Therefore, it is important to analyse SDGs and complexities faced by firms in obtaining a steady flow of materials from other countries.

The firm's internal KRs may change in order to fulfil objectives such as employment generation, upgrading to sustainably-created products. Developing a communication platform for local suppliers to interact with firms was deemed important by the participants. According to RD1, *"I also needed a change in the entire value chain. We need a green/sustainable value chain so we can start planning and design, based on that value chain. I need this value chain to have specialists and consultants ready to give their opinions at any time as needed and in return for financial returns agreed upon at the start of the SBM"*. Creating a technology interface platform enabling a DC with suppliers of construction materials and manufacturing of equipment ranked high on the list of changes the firm could undertake. HCCs could start by hiring sustainability experts that dedicated their efforts to assisting senior management in taking strategic decisions on SBMs development. This would, in turn, replicate a business philosophy that was understood and followed by its employees and every value chain member. Large HCCs would benefit greatly by upgrading their value chains since the input required is capital intensive, thus giving them a future edge in market.

Value chain upgrades can create strategic partnerships with suppliers that produce automated building systems, according to RD1. Participants were largely in favour of automation that reduced cost and time of construction while producing less waste. They also wanted government support while upgrading the value chain as they lacked the scale, capital and technologies required to be competitive. According to CO1, *"it (referring to the HCC) has to integrate itself in the creation of a sustainable society. However, this is not possible when firms targeting sustainability are forced to operate in an economy thriving on unsustainable practices. All the BMs should include interaction with external agents, entities and shareholders to create sustainable value. It is possible to deliver the anticipated social progress and environmental benefits when sustainable BMs meet thriving economic conditions"*. Thus, a firm's competence is dependent on the prevalent economic conditions. A supportive and sustainability-oriented economy would aid in smooth transition of its members towards sustainable development.

Firms seeking a SBM in developing nations should target process upgrading. In Saudi Arabia, publicly funded research into new construction materials for building walls and floors, and policies that provided subsidies for replacement of old construction materials with new ones was found to be improving productivity. Likewise, HCCs that targeted product upgrading, moving away from brick and concrete construction to use of reclaimed steel, recycled paper tiles and glass tile mosaics, were appreciated for their innovative methods.

In conclusion, voluntary upgrades of value chains by HCCs should match local and global standards, such as LEED, BREEM and SBC mandates. Firms seeking to leverage the credibility of exporters overseas could try to break away from the commodity trap and build more value into products in the Saudi HCI.

- **Media & Education Support**

Media plays a powerful role in education and spreading awareness by opening up access to information and supporting civic participation. In general, participants felt media could facilitate good and effective governance through investigative journalism, such as employment of a child and female workforce, salary structure of workers, use of sub-standard building material, and environmental impact reporting. The media has been viewed as a bridge between firms, government and consumers in the past. This section reviews the changes in media and education support, which could contribute towards community empowerment, public policymaking and the role of media in realising SBMs in the Saudi HCI.

With an ever-increasing digital footprint, HCC are becoming increasingly aware of the added advantage they would receive by investing in spreading awareness about sustainability practices. Practitioners believed, to some extent, that support from media on sustainability and SDGs, and challenges affecting the global market and society, would bring a change in outlook. As CO3 said, *"especially in the era of social media that makes many inventions at hand and make use of them is possible in the world of application and implementation"*. Consumers will begin appreciating the SBM as they earn credits in the form of subsidies for choosing sustainable products that they can later promote on social media to create further awareness.

In summary, the external environment driven by media support and consumer education on SBM is crucial from the participants' point of view. Media intervention programs to educate the public on the real costs of unsustainable BM development and to encourage them to consider the total cost of SVPs would be welcomed by HCCs. Therefore, media is an important stakeholder, both as a contributor and a beneficiary.

- **Engagement and Collaboration with the Public**

Participants recognised the importance of consumer and stakeholder engagement and collaboration by asking themselves this simple question, *"What role does a customer play in the development of our products and services?"* In general, participants portrayed strong beliefs that consumers were interested in taking an immersive role in product innovation and guiding the routes of housing design and maintenance contracting according to their preferences. Participants recognised that it was necessary for their firms to respond to consumers' dynamically changing needs to meet the expectations of targeted customers. Changes in KRs are critical and a key success factor for developing dynamic and engaging BMs through public participation, engagement and collaboration. Simply put, SVP involve capturing buyer interests, starting from the project planning phase to the end of project activity (i.e., project lifecycle approach).

In many ways, CRs thus form an intrinsic part of SBMs because they directly link customer satisfaction with value offering. According to UN3, collaboration with TCs improved social sustainability factors adding to community building and engagement. For example, CO2 said, *"the sustainable approach starts with CR, where there will be a relationship with the TC by engaging and interacting with them; engaging them in the process of development activities while following the principles of sustainable design and sustainable production, which reduces the environmental impact and raises the quality."* Therefore, TCs have greater recognition as key stakeholders and their requirements are strongly aligned with the firm's value generating potential.

In general, participants are optimistic of the outcomes arising from engagement and collaboration with public as they in the past fail to meet their demand. However, awareness, low market demand and minimum support from the government in facilitation of sustainable objectives was identified, by some participants, as a limiting factor. They readily agreed on the benefits arising from engagement with educated consumers; however individually, they were not keen on taking up a larger role in consumer awareness and education. As a recommendation, they promoted the idea of using PNs and media DCs to support SBMs. According to UN3, *"sustainability is a necessity and it is not an option; but it needs to join efforts at different levels. The transformation has not happened yet. It needs a culture that believes in change. This would affect the HCI."* Here, UN3 was emphasising the need for development of a two-way relationship that results in mutual benefits.

The recommendations made by the university professors and contractors aimed at building stronger and long-lasting relationships with the public sector through firm-based initiatives and government channels. According to UN2, professor of housing and environmental design, firms had to constantly search for engagement opportunities with consumers through their own marketing channels as well as publicly-financed projects. Engagement and collaboration are about bringing the consumer closer to development activities of a HCC and achieving the bottom-line set forth by these entities; housing development firms, government agencies and consumers.

Reviewed the participants response in identifying changes required in the HCI to transform BMs into SBM, it is imperative to view the entire SBM as a value creation tool that support environmental and social objectives while making financial sense to the investors. The next section discusses the opportunities and challenges a HCC encounters while transforming to a SBM.

5.4.5 Challenges of SBMs

Rapid urbanisation in developing countries calls for major changes in the way urban development is designed and managed. The substantial increase in public and private investments in urban infrastructure and services faces multiple challenges that arise in the form of exploitation of labour, materials and building processes. Discussion with experts from the Saudi HCI highlighted the global challenges driven by a broad set of 'megatrends' such as changing demographic profiles, economic and social dynamics, legal frameworks, policymaking, technological innovation challenges and general trends towards a deteriorating environmental resource base. Interview with the participants on SBMs transformation within their firms and within the HCI was requested by the interviewer. The responses were divided into six main factor groups named PESTEL: political, economic, socio-cultural, technological, environmental and legal challenges. Over the course of the interviews, it was discovered that social challenges were given the highest priority by the participants, followed by legal, technological, political, economic and environmental challenges. The remarks made by the participants were based on their understanding of trends observed and the changes they thought were needed to realise sustainability in their BM development. This section investigates the challenges experienced by the Saudi HCI according to the aforementioned six themes or factor groups. The analysis is aimed at recognising sustainability practice through integration and coordination, which includes lack of awareness, lack of regulation, inadequate stakeholders' collaboration, lack of sustainability assessment model, lack of clear environmental policy, low sustainable practices, hard to match demand, resource conservation challenge, biodiversity challenge and more will be presented below. The list of challenges to SBM is presented in figure (5-13) below:

Name	Sources	Refere...	Created On	Created...	Modified On	Modified By	Color
Challenges SBM	0	0	9/2/18, 3:52 AM	ADNAN	11/22/18, 10:33 PM	ADNAN	
Economic	0	0	9/2/18, 3:53 AM	ADNAN	11/22/18, 2:22 PM	ADNAN	
Environmental	0	0	9/2/18, 3:54 AM	ADNAN	11/22/18, 10:31 PM	ADNAN	
Legal	0	0	9/2/18, 3:54 AM	ADNAN	11/22/18, 10:30 PM	ADNAN	
Political	0	0	9/2/18, 3:53 AM	ADNAN	11/22/18, 2:23 PM	ADNAN	
Social	0	0	9/2/18, 3:53 AM	ADNAN	11/22/18, 2:20 PM	ADNAN	
Technical & Technologi...	0	0	9/2/18, 3:54 AM	ADNAN	11/22/18, 10:29 PM	ADNAN	

Fig 5-13: Challenges of SBMs

- **Economic Challenges**

A series of discussions with interviewees from the Saudi HCI reveals the financial limitations that restrict the evolution of SBMs in the HCI. As participants shared the challenges they faced within their HCC and outside in general, they also believed in strengthening economic governance through redirection of the financial sector and sharing of profits and employment opportunities. Participants, while seeking SDGs, encountered issues such as limited financial initiatives, high upfront costs and cost of green materials. Financing a SBM is still viewed as a risky proposition for some HCC in the absence of appropriate safeguards. While some participants were concerned about recovering their investments, others were not so keen about the whole life savings concept as the payback time was not convincing for their investors. The overall macroeconomic environment supporting low energy costs from non-renewables, and availability of unskilled labour from nearby countries to work in simple housing development, created macroeconomic obstacles for which firms needed support to overcome. A list of economic challenges is presented in the figures (5-14 & 5-15) below:

Name	Sources	Referen...	Created On	Created...	Modified On	Modified By	Color
Economic	0	0	9/2/18, 3:53 AM	ADNAN	11/22/18, 2:22 PM	ADNAN	
High Upfront Cost	11	20	9/2/18, 4:08 AM	ADNAN	11/22/18, 1:35 PM	ADNAN	
Limited Financial Init...	11	22	9/4/18, 2:32 PM	ADNAN	11/22/18, 1:47 PM	ADNAN	
Capital cost vs whol...	10	14	9/4/18, 2:30 PM	ADNAN	9/8/18, 2:46 PM	ADNAN	
High Prices of Gree...	9	17	9/6/18, 2:14 PM	ADNAN	11/22/18, 2:13 PM	ADNAN	
Lack of information f...	9	13	9/4/18, 3:57 PM	ADNAN	11/22/18, 2:22 PM	ADNAN	
Risky Business	9	17	9/4/18, 2:33 PM	ADNAN	11/5/18, 3:51 PM	ADNAN	
Low Demand & Slow...	7	12	9/9/18, 4:00 PM	ADNAN	11/5/18, 3:53 PM	ADNAN	
Not proven as econ...	7	14	9/4/18, 2:42 PM	ADNAN	9/9/18, 4:16 PM	ADNAN	
Lack of Funding and...	4	8	9/9/18, 3:27 PM	ADNAN	11/23/18, 12:39 AM	ADNAN	
Instability of Variabl...	2	2	9/9/18, 3:54 PM	ADNAN	11/23/18, 12:40 AM	ADNAN	
Low Energy Cost	2	4	9/9/18, 3:45 PM	ADNAN	11/23/18, 12:39 AM	ADNAN	
Payback Time is not...	1	1	9/9/18, 4:01 PM	ADNAN	11/23/18, 12:40 AM	ADNAN	

Fig 5-14: Economic Challenges

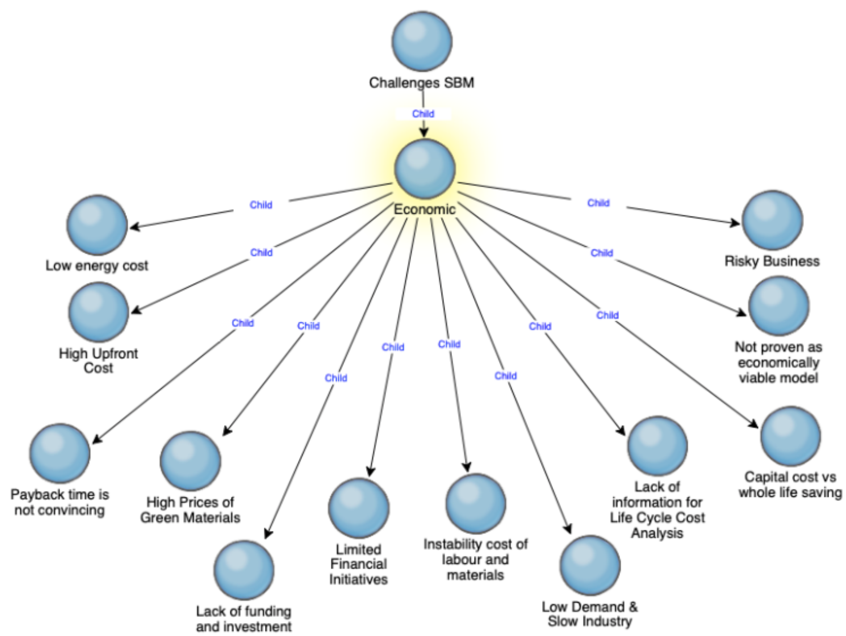

Fig 5-15: Economic Challenges

Limited financial initiatives were seen as major delimiters for HCCs, investors, developers, designers, architects and consumers. This challenge appeared in the implementation of Zero Energy Homes (ZEH) in Saudi HCI literature and appeared as a challenge for the SBM application (Alrashed & Asif, 2012; Saied Al Surf et al., 2013). Declining oil prices in past years (2015-2017) have cut government investments almost by half in the HCI. This directly impedes new initiatives, such as Saudi Vision 2030 and the NTP. Vision 2030 plans to reduce the nation's dependence on oil for capital generation while diversifying the economy to develop public sectors, such as real estate infrastructure (Al Surf & Mostafa, 2017; Vision 2030, 2016). Although, the NTP 2020 is regarded as an economic action plan subsumed under the Vision 2030 development plan, the idea is to diversify economic growth to industries other than oil. The diversification of budgets as part of the Vision development plan may help meet the challenges of public and fiscal reforms, improve business environments and social reforms. More importantly, it will prepare the country to increase its revenue generation capabilities from non-oil investments. As CO3 mentioned, *"there are certainly incentives to implement sustainability, either through the country development authorities or through the municipalities' special projects, but this encouragement is verbal support and, personally, I think it is inadequate and unsatisfactory."* Therefore, the initiatives reported in the NTP across multiple ministries and government bodies will play supporting roles for sustainable businesses to grow. In the words of RD4, *"there should be a system in the country that encourages citizens and companies through a system called sustainability rewards, and it may be that these bonuses for superiority give the contractors an alternative opportunity from that of peers in the market."* Programs run by the Ministry of Labour and Social Development that focus on developing housing units for needy families should be supported by the Ministry to assist low-income customer segments through loan guarantee programs. Such initiatives could work in favour of contractors and HCCs as they receive a rating for successfully delivering inexpensive, affordable, environmentally friendly and customer-oriented SBMs.

The seemingly high upfront cost in implementing sustainability in BMs with long-term payback for developing firms can easily change investors' minds as they are looking for the highest returns in the shortest possible time. This challenge appeared on a global and national scale in the literature of sustainable building (Saied Al Surf et al., 2013; Seyfang, 2010; Zhao & Pan, 2015). Although it is hard to change the capitalistic views of investors, not all investors are sustainability averse. Investors can directly fund affordable housing projects for lower income families by purchasing sustainable and green bonds. Green, social and sustainability bonds are any type of bond that will generate capital, for application primarily in eligible social and environmental projects. This approach could address the concerns of UN3, who stated, *"sustainability has high initial costs but results in a product that is long lasting, has lower long-term impacts and greater long-term benefits."* High costs of development are also perceived as resulting from absence of sustainable businesses, sustainable value chains and professionals, as discussed earlier in the literature of sustainable growth in GCC countries (Asif, 2016). As CO3 pointed out, *"the scarcity of sustainable businesses, sustainable value chains and professionals makes the value creation phase equal, or sometimes more than the regular product creation."* The high cost of value creation activities and pre-construction phases must have regulated financial support from investors, government and partner networks, so that firms engaging in creation of SVPs can deliver SVP with post-construction under multiple value delivery models. According to MH2, *"we have recently seen SABIC's sustainable home experience, and the product is, of course, a stunning, high-end product, but a $2 million price is high for the customers, so I do not see that product socially, economically and economically sustainable."* Thus, the principle of sharing upfront costs, development risks and benefits must be shared equally by the consumer, investor and developer.

High upfront costs of the SVP creation phase are closely linked to limited and high price of green materials. This challenge is also discussed in the SHPs literature from an expert's view (Saied Al Surf et al., 2013). As materials, construction and labour consume over half of the project costs, an abundance of green materials from reliable local supply chains would support projects willing to adopt green materials in construction. As CO3 mentioned, *"the construction materials, elements of renewable energy, local and green materials remain expensive because they are scarce in the market."* Design principles, in many ways, affect SBM development as there are many rating systems, certifications and recycling parameters besides adopting local and green materials. As the success of projects depends on the standards adopted for labour, management, design and construction, it is a risk that HCCs bear until obtaining clearance for use. In this regard, HCC can stand to lose their financial position unless the government and international institutions support them with sustainability-oriented policies. As MW1 argued, *"there is less desire from the investors to* *invest in sustainable businesses and there are also fears of loss due to lack of regulation for the sustainability practices in the construction industry, beside scarcity of green materials."*

On the customer front, price dictates sales as HCC are unable to justify the investments made in technology, design, execution or maintenance. Customer views the price paid as the total capital cost and does not realise the low operating and maintenance costs as part of savings made from the better-quality SVP or the renewables resources savings. As RD2 stated, *"payback time is not convincing."* Therefore, a pragmatic shift is required to enable customers to see the social and environmental benefits as opposed to purchase price. Customers are willing to pay more if maintenance companies can streamline the process of taking care of the SVP with financial guarantee post purchase. Similarly, the insurance sector can take care of regulation of premiums for covering the lifecycle costs of the SVP. As MM1 said, *"people think only of the quick and not the long-term returns. Savings here is a possibility, but it is the time that will show that saving."* According to Aho (2013), a change in mindset is needed by the whole industry and customers for a business to be sustainable: higher risk must go hand in hand with better performance and results. A cultural shift where customers pay for performance rather than cost will support and grow SBMs implementation.

The SBM has not proven to be an economically viable model due to capitalistic marketing policies in which profitability overrides performance and cost overrides quality. The prices of green construction materials, construction methods and green innovations and technologies should be able to deliver a cost-friendly product that can compete in the existing markets. Therefore, HCC could enhance each TCs awareness of sustainability (CO1) or reduce prices, which in some cases increases demand (RD2) as a mechanism to prove economic viability. As MM2 mentioned, *"the country is still developing and the change in caring for the environment and the people is still in the budding stage and needs a very long time for such a model to operate, benefit the market and prove its worth."*

The rate of progress in transitioning towards a SBM would be expedited when firms take cognisance of lifecycle costs. CO3 commented on the need for studies on estimates concerning financial matters, especially the lifecycle costs of products, availability of accurate information about the products and prices, which is critical for development of suitable deals for the TC. As some participants highlighted the shortage in demand, this was linked to slowdown in economic growth. The SBM relies on demand, which could, in turn, drive prices down. In this regard, MH2 argued that the demand scarcity for sustainable products is due to lack of consumer awareness: *"the customers want a product with high quality, and what limits them is the high cost."* Therefore, customer relationships are equally important, so that designs are made as per customer needs and alternatives are available for modification without affecting the model. However, RD1 raised a concern about SBMs, citing problems with approval of such models. He states that, *"implementation of sustainability in the model (means SBM) will face some kind of delay in the approval and in the development process of the project as, for example, the services and facilities, such as schools and mosques, will not be approved by the by the ministries quickly because of the small population density at the beginning of the project."* This is an important issue since firms and investors want to build projects where land prices are low. It allows them to construct environmental applications, such as solar grids, solar parks, rainwater harvesting and sewage treatment facilities. They can use land for social development purposes, like schools, mosque, parks, and clubs. The parent firm wants to buy land for the project at the lowest cost, which positively impacts the SBM and the firm's financial model.

Among the several economic issues regarding the development of SBMs is the funding and gathering of adequate resources that allow firms to create, capture and deliver value. The level of funding generally sets the tone for the scale of development and the quality of the product. RD stated that, *"obstacles can be overcome by targeting the financial resources that set the objectives of the sustainable development within their projects and the sources of money disbursement or facilitate procedures, such as banks and social responsibility programs."* He also emphasised that HCC should target big strategic and special projects in their country besides their own independently managed projects. While this would help firms grow, and develop a diversified portfolio, it should generate additional capital to support newer projects and add capabilities for the firm and its partners. Banking institutions must take steps to ensure funds meant for social sustainability are used judiciously. RD3 argued, *"there is no support or funding from banks as part of their social responsibility in supporting such models, although banks are required to participate in the society."* For HCC wanting to build and operate a SBM, it is important to have financial resources and support from investors that share the same goals.

Participants have predicted that given the trend in energy prices, which directly rely on global environmental conditions and the earth's own resources, the price of renewable energy will compete at a par with oil- and coal-derived energy in financial markets within this decade. According to the latest report from the International Renewable Energy Agency (IRENA), just a few years from now the cost of renewable energy will fall so fast that it will be a consistently cheaper source of electricity generation than traditional ones (IRENA, 2019). In some regions globally, the price of renewable energy has become affordable, as well as in some parts of Saudi Arabia, especially if there had been no previous access to an energy network. This phenomenon, when combined with the low cost, very large-scale photovoltaic production factories in place in China, gives an indication that renewable energy prices will fall further over the next decade. However, contrary to this view, MM2 argues that, *"although the price of energy during the past years has increased three-fold, and there are rumours of government subsidies being increased, prices still do not encourage citizens to consider renewable sources of energy because the price, so far, is not feasible'*. Similarly, RD2 added, *'it is unwise to apply renewable systems because energy prices so far will not cover the cost of PVs; although energy prices are high, they are not covering the costs of implementation and pumping to the renewable energy grid."* In addition to this, the price of solar panels is yet to go down further until its use makes economic sense; solar panel costs should be considered as a lifecycle cost rather than being compared with the cost of acquisition. Aho (2013) and Sweetser (2012) stressed that Energy Performance Contracting (EPC) may deliver credible performance improvements allowing the service provider to be rewarded for implementing sustainable energy solutions and sharing the benefits of reduced energy costs. Therefore, rewards for projects using efficient methods of conserving natural resources through the involvement of EPC and similar companies are required to drive down costs without affecting quality or consumer needs.

As discussed in this section, the impact of variable costs – construction, materials and labour taking over half of the total project cost, its volatility in domestic markets proves to be a hindrance to achieving sustainability. RD1 states that, *"there remain financial difficulties* *you do not have a hand in related to the country and its sector, the competence of the economy and unstable prices of labour prices, materials and energy."* While such problems have a direct and immediate impact on the SBM, they are external in nature from the firm's point of view. Such problems can be classified as political, technological, and environmental and so on. However, as Saudi Arabia seeks to build a stronger economy, which requires investment in projects built on principles of quality and sustainability, the political, financial and social sectors must combine their efforts to achieve sustainable development outcomes (Vision 2030, 2016).

This section provides an overview of the economic challenges facing the implementation of the SBM in the housing construction industry, covering economic challenges affecting delivery of SVPs, while engaging the end-user in community building opportunities. The HCCs' high upfront costs in development need to be financed by customers in the absence of government support, or by sharing costs with other partner in the value chain. The Saudi government in this context could support and improve the conditions of SBM development by regulating and monitoring the cost of labour, construction and green materials. In summary, to achieve economic sustainability of the SBM, the challenges of development, financial risks of investment and long payback time must be addressed. In addition, partnerships that distribute financial risks and high upfront costs for the customer are needed. This would allow partnering organisations to become industry leaders in the sustainable movement, increasing demand as more people see the benefits of the SBMs. The next section provides information about the environmental challenges facing implementation of SBMs.

- **Environmental Challenges**

The discussion on environmental challenges responsible for slow implementation of the SBM was divided into four areas: shortage of natural resources, climate change issues, high waste industry and difficulties becoming a low-carbon industry. Globally, population growth is slowing, but what is interesting is that population growth is concentrated in countries whose contribution to global environmental challenges is comparatively small (Peterson, 2017). Participants expressed concerns about access to clean water, discouraging high-energy consumption in high-income households and taking an environmentally centric view of building construction. The environmental challenges faced by HCCs resulting from socio-economic limitations while seeking SBM development for target customers are discussed in this section. List of environmental challenges is presented in figures (5-16 & 5-17) below:

Name	Sources	Referen...	Created On	Created...	Modified On	Modified By	Color
Environmental	0	0	9/2/18, 3:54 AM	ADNAN	11/22/18, 10:31 PM	ADNAN	
Shortage in Natural...	11	18	9/6/18, 4:06 PM	ADNAN	11/22/18, 11:00 PM	ADNAN	
High Waste Industry	6	7	9/4/18, 3:21 PM	ADNAN	11/22/18, 11:01 PM	ADNAN	
Climate Change Issu...	5	10	9/4/18, 3:23 PM	ADNAN	11/22/18, 11:01 PM	ADNAN	
Hard to be Low Carb...	3	3	9/9/18, 4:15 PM	ADNAN	11/22/18, 11:02 PM	ADNAN	

Fig 5-16: Environmental Challenges

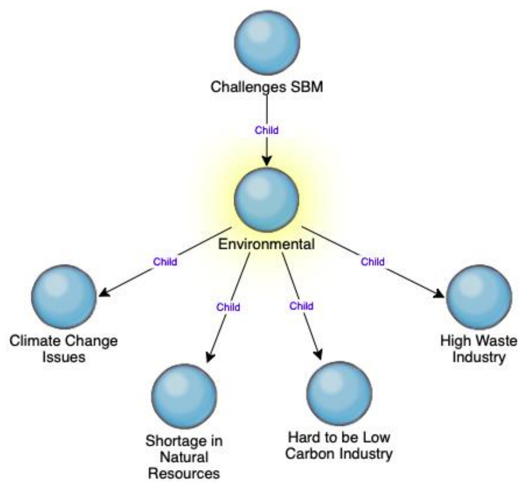

Fig 5-17: Environmental Challenges

Climate change, a focus of SHPs literature (Susilawati & Al Surf, 2011) was recognised as a strong environmental challenge for the SBM by participants from the HCI. However, some were not clear on how these issues would affect SBM adoption in their respective fields. According to CO2, *"environmental issues are fundamental to the sustainable model, because the country is experiencing a limited supply of natural resources, which may restrict development of the work model. In addition to this, the country is suffering from the amount of waste and gases generated continuously from the construction industry."* However, it is possible to disagree with the statement about availability of limited resources. Saudi Arabia, with vast amounts of non-renewable resources, also has the potential to tap into renewable energy, such as solar energy and wind farms; and oceans for tidal and wind energy. As for construction materials, the government can trade credits with countries with an abundance of timber and concrete, or choose to develop using locally available materials, such as aluminium composite panels and gypsum boards. For example, firms have suggested using modern methods of construction to build houses at an affordable cost to the Saudi consumer.

The government created ambient air standards in 2012 (Alturki, 2015) to limit construction activities near cities, which served to restrict the spread of particulate matter. Likewise, the government has established environmental standards for noise, water use and wastewater dispersal. With the change in global temperatures contributing to rising sea levels, wastewater treatment and infrastructure for sewage management will face increasing pressure from a growing population.

Climate change issues present an ever-increasing opportunity for firms to understand, prepare and improve their capabilities. According to MH4, *"the gulf region has the world's most challenging water scarcity and a reliance on climate-sensitive agriculture, as well as coastal centres of population and economic activity."* However, it is up to the government to transform ideas into action and introduce policy changes that help firms marketing less resource intensive yet highly durable products; for example, modern methods of construction, wastewater management systems and thermal systems to expand and compete with traditional methods of construction.

Alternatively, HCCs can reduce their environmental impact, focussing on internal operations, site selection, reliance on internet-enabled technologies that reduce communication overheads and paperwork, outsourcing project areas to sustainability experts; thus, reducing their carbon footprint. In relation to high waste industries, CO2 remarks that, *"environmental issues are fundamental to the sustainable model, because natural resources may limit the development of such a model."* Therefore, BMs aiming to achieve sustainability should limit the use of natural resources without affecting the quality of the product or the price. Limiting the waste produced by the VC processes and their environmental footprints must also be considered. Waste generated as a result of development should be viewed as a lifecycle cost and handled effectively.

As the HCI is a highly polluting industry, shortage of natural resources due to overconsumption is inevitable. The HCCs must decide on the key resources, such as choice of materials and energy and water supply for VC. For example, they could develop a power transmission network between the site and the nearest energy transmission hub and follow it up by developing a site for solar farms before moving into the construction phase. The choice of solar farm will depend on the difference in energy price estimates for the next 20 years to calculate the offsetting cost and time. Where solar farms are not a feasible option because of low energy prices, such as projects near cities and populated areas, firms can trade off solar-based solutions with sustainable solutions in other areas, such as building a robust sewage network, designing buildings that use more natural light and wind for cooling. The goal is not to be low carbon SVP, but as close as possible to the lowest carbon emissions without hurting the financial model. As RD2 pointed out that, *"for becoming sustainable it is unwise targeting zero carbon products, as although these products are supposed to be environmentally sound, I doubt that, and the products are overpriced; so what I want to say for the BM is that the sustainable steps should be taken carefully"*.

The growing risk of climate change with an increase in atmospheric carbon emissions may seriously influence availability of natural construction materials (World Green Building Council, 2013). Shortage of natural resources is becoming increasingly evident in developing world countries due to deforestation leading to desertification in many healthy regions of the world (Mohammed Saied Al Surf et al., 2014). The absence of green methods of construction are likely to lead to more wastage of raw materials, which could be used by other processes, firms or industry. HCCs can earn the reputation of being pioneers of low carbon industries when they adopt the principles of sustainable design from the top to the ground. It is important to analyse the costs of construction, engaging experts to adopt sustainable development where it makes good business sense, using some natural materials if necessary, to keep costs low. This section has provided insight into some of the challenges that firms have faced or will face when they move to using SBMs.

In conclusion, environmental challenges, such as scarcity of raw materials, energy and waste utilisation infrastructure, poses a threat to the success of SBM adoption. In this regard, HCCs can seek help from partners. Government can take a leading role in supporting HCCs that use less environmental resources and provide certified SVP in the form of financial support. HCCs can invest in environmental-friendly construction with business revenue logic that recovers investment from customers over the duration of the entire project lifecycle. Next section provides information on the legal challenges of implementation of SBM.

• Legal Challenges

For the SBMs to be successful, it is important to overcome the legal challenges that limit the existing BMs and approaches to construction in the HCI. This view stems from legal challenges reported by the participants. In total, six areas in which firms were experiencing legal issues were reported; i.e., absence of legal framework for sustainable construction, lack of collaboration between stakeholders, unclear building code, lack of inclusion in procurement arrangement, export and import restrictions and lack of new and flexible regulations. Among these legal challenges, lack of clear and supportive laws for firms investing their resources in SBMs was the most cited issue during the interviews. The list of legal challenges is presented in figures (5-18 & 5-19) below:

Name	Sources	Referen...	Created On	Created...	Modified On	Modified By	Color
Legal	0	0	9/2/18, 3:54 AM	ADNAN	11/22/18, 10:30 PM	ADNAN	
Lack of Regulation a...	16	35	9/7/18, 12:34 AM	ADNAN	11/22/18, 10:33 PM	ADNAN	
Lack of Collaboratio...	15	20	9/4/18, 4:26 PM	ADNAN	12/10/19, 3:08 AM	ADNAN	
Unclear Building Code	7	11	9/4/18, 3:38 PM	ADNAN	11/22/18, 11:08 PM	ADNAN	
Export and Import R...	5	6	9/2/18, 4:01 AM	ADNAN	11/22/18, 11:09 PM	ADNAN	
Not Included on the...	4	7	9/4/18, 3:41 PM	ADNAN	11/22/18, 3:30 PM	ADNAN	
Lack of new and Fle...	2	4	9/9/18, 4:24 PM	ADNAN	11/22/18, 11:09 PM	ADNAN	

Fig 5-18: Legal Challenges

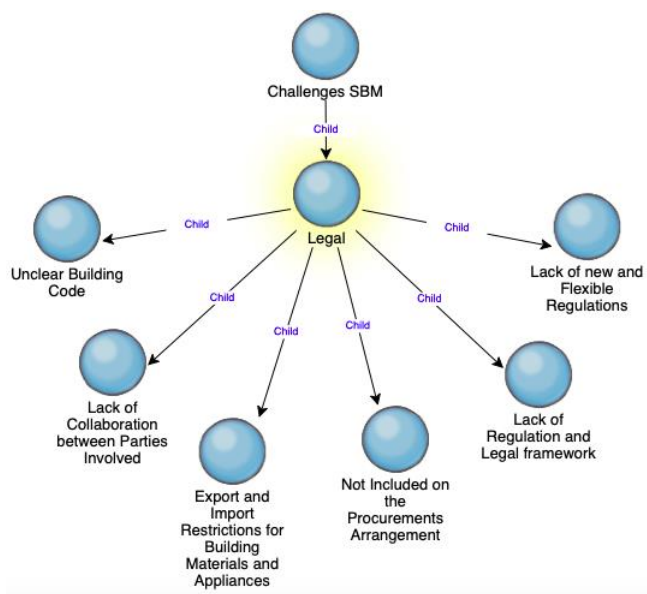

Fig 5-19: Legal Challenges

The importance of legislation in establishing SDs principles in the HCI was clearly recognised by participants. As reported by Susilawati & Al Surf (2011), inadequate regulations for the implementation of sustainability in housing projects has presented huge challenges for SHPs, and similarly, it appeared to participants to be a legal challenge for SBMs development, although legal issues themselves could present unique challenges since any modification in building law and code could potentially upset the HCI. This phenomenon can be understood by observing the legal structure of government ministries, such as the Ministry of Housing and the Saudi government in particular. For example, RD1 argued that, *"… today we need time to ensure all procedures and systems present a clear picture, and I consider this is a good opportunity for the owners of businesses in the HCI to ask themselves if they will be able to face this global change in the move towards a sustainable future."* Therefore, it can be said that HCCs are looking forward to policies that favour sustainable construction, distinguishing it from traditional construction methods for the benefits of the SBM.

Cost and schedule overruns were typically common in traditional BMs along with unclear requirements and changes in legislation that directly affected firms' KRs and RM, for example, the low-bid procurement system that awards contracts to the lowest bidding company. In such projects, HCC are prevented from constructing quality products due to small revenue streams on top of other constrictive measures, such as limited space for development and use of government approved contractors for development. As an alternative, low-bid procurement can give way to online marketplace bidding systems that check company credentials and experience in the industry. This helps the government to select and choose to work with sustainability-oriented HCCs for large- and medium-scale housing projects. Also, the Saudi building code needs to address the design, development, operations and maintenance aspects of development with precision, keeping the customer at the core of all business processes. Participants felt that the Saudi Building Code (SBC) was in its nascent stage as it: a) lacked building codes designed with Saudi environment and culture in mind b) adopted a rudimentary style of coding without much appreciation of the social factors and c) was yet to be taken seriously by firms due to lack of clear guidelines for assessing organisations. Thus, CO1's statements that, "*there is no appropriate legislation dealing with forms of sustainability in the construction sector; I mean social, economic and environmental"* is true and appropriately conveys the message. According to RD1, *"the building code in Saudi is suffering from low quality and clarity, as well as not including environmental and social aspects, a sustainable clear building code is needed."* In relation to the impact of communication in building construction activities, mentioned earlier, lack of collaboration has affected almost all areas of the development of SBMs. As a solution, land chosen for the development could provide social and recreational services for which the developer is not directly involved but requires different ministries to take up its development. In this regard, CO2 identifies that, *"lack of connection between departments responsible in the government."* Therefore, ministries of health, social and religious welfare should collaborate with the developer and partners at times to execute these amenities at the time of constructing the housing units. MH1 makes the point that, *"stakeholders in the Saudi HCI market should combine efforts and unite their goals to promote high-quality and efficient SBMs for the benefits of the HCI*.'

The evolving political environment affected legal views, which reflected in the policymaking of leaders observed over a period of time. RD6 explains that, *"there is a problem in the rules and regulations as they are inflexible or have no space in creativity, inventions or acceptance and do not accept the new construction solutions quickly."* The unipolar leadership, which has changed over successive generations, has played a pivotal role in slowing the green development in the Saudi construction industry and the economy in general in times of geopolitical crisis. Providing specific, measurable, achievable, relevant and time-based solutions while setting objectives could be achieved when the vision is clear; to move slowly and steadily towards a SBM of development and managing the HCC effectively during this transformative process.

In conclusion, HCC should support the development of a legal framework that defines sustainable development and application over traditional approaches. Since a SBM is a transformative process, HCCs will be unclear where they stand in the sustainable movement unless laws clearly distinguish them from other similar organisations. The next section provides information about the political challenges facing the implementation of SBMs.

- **Political Challenges**

Most participants viewed political issues as a leading factor responsible for the slow uptake of the SBMs. The political environment of the country and the view of its leaders play a vital role in the success of any sector, industry or business. The political challenges that emanated from the observations made by the participants are combined in seven commonly identifiable themes. These factors are lack of clear policy, instability in regulations, lack of understanding of the term ‘sustainability’, limited political support, lack of support from top management at the HCC, lack of appreciation from the government procurement system and lack of interest in investing in research and development. While all these factors had origins in politically backed interests, the most common and reported challenge was the lack of a clear and consistent policy on sustainable business development and sustainability practices in the HCI in particular. This section describes and takes a closer look at the politically motivated factors that inhibit growth of SBM in the HCI. The list of political challenges is presented in figures (5-20 & 5-21) below:

Name	Sources	Referen...	Created On	Created...	Modified On	Modified By	Color
Political	0	0	9/2/18, 3:53 AM	ADNAN	11/22/18, 2:23 PM	ADNAN	
Lack of Clear Policy...	12	25	9/4/18, 2:26 PM	ADNAN	12/10/19, 3:08 AM	ADNAN	
Lack of Clear Definit...	9	11	9/4/18, 2:25 PM	ADNAN	11/22/18, 1:22 PM	ADNAN	
Lack of Top Manage...	9	10	9/2/18, 4:15 AM	ADNAN	12/10/19, 3:08 AM	ADNAN	
Lack of Support	7	11	9/4/18, 2:28 PM	ADNAN	12/10/19, 3:08 AM	ADNAN	
Instability of Regulat...	6	11	9/2/18, 4:04 AM	ADNAN	11/22/18, 1:21 PM	ADNAN	
Government Appreci...	5	7	9/2/18, 4:14 AM	ADNAN	11/22/18, 1:22 PM	ADNAN	
Low Research and D...	2	3	9/9/18, 4:18 PM	ADNAN	11/22/18, 10:26 PM	ADNAN	

Fig 5-20: Political Challenges

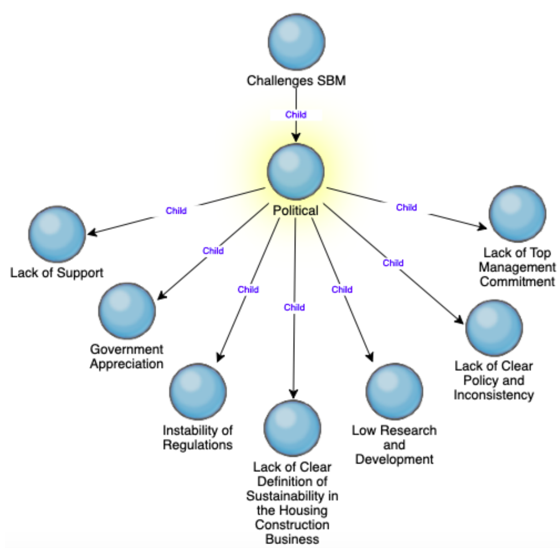

Fig 5-21: Political Challenges

Policies created by the Saudi government supportive of sustainable growth in the HCI have been commonly acknowledged by the participants. Such support was also evident through the NTP. However, participants also targeted the ill-advised policymaking affecting investment portfolios of the government and its projects. Few participants had a positive outlook and believed the government to be moving towards a promising future in the HCI except for the renewable energy initiatives. The participants highlighted the importance of clarity in government policies. As such, RD1 said that, *"developers need to know where they stand, and what the government expects from them."* However, HCCs targeting SBMs transformation were likely to face difficulties if they failed to establish a clear set of capabilities and partners to create and deliver value. The ambitious SBC and its set of directives on safety, construction, design, materials, operation and maintenance is likely to meet resentment from sustainability-oriented developers since it lacks special provisions, standards and benefits for firms adopting sustainability in their business model. Therefore, the Ministry of Housing must recommend changes in SBC to include firms that achieve sustainability practices in their upcoming projects. As RD1 said that, *"we need time to ensure all procedures and systems have a clear picture."* Therefore, the policymaking routine should convert the high-level objectives of the government into clearly-defined rules for the firms to follow.

In recent years, participants have experienced issues in obtaining a single license as they have to seek permission from multiple government agencies individually, thus wasting time and resources. While the government has been proactive in creating several departments, each managing a specific area of public service, it is difficult, according to RD1, *"... to seek permission from each ministry before starting a project; for example, imagine taking a license to develop residential real estate that does not include licenses for the construction of mosques, schools and health units. So how would you be building these facilities, such as the mosque, which the municipalities promised to build? Will it be handed over by the Ministry of Islamic Affairs? The same applies to other facilities and services*." The government must streamline its channels to provide a single point entry for all applications, which would be distributed further to each sub-division, department or municipality according to the requirements set by the developing firm. For example, the MOH receives all applications and, depending on the list of approvals needed by each project, forwards the application to the concerned departments in a time bound manner. In projects that provide empty land areas for future development, firms should be allowed to seek individual approvals, depending on their planning and design requirements. As RD1 puts it, *"one of the problems facing the implementation* [meaning SBM] *is the instability of the systems and* *laws."* Therefore, policies should be created and altered, Taking the larger subset of people and their needs into consideration.

The HCI and government institutions view sustainability from different perspectives. The government looks to the private sector to lead sustainable practice efforts and learn from them, while the private sector meets resistance from the same government agencies responsible for approving building plans, materials and construction methods. The lack of a working relationship is evident in the words of RD3 as he says, *"there is no clear scope for the definition of sustainability in our sector."* Firms have received criticism for making statements in public in favour of sustainability, when this was just a cover for unsustainable practices or rampant misuse of environmental resources. According to RD4, *"acting within existing laws and regulations until the adoption of new texts and legislation allows us to deal within the limits of this definition and these standards."* HCCs are moving ahead with residential projects despite knowing that there are no clear sustainable guidelines and laws made for the development and growth of the HCI.

According to some practitioners, the supportive role of the government in taking up sustainable practices was vital for HCC to flourish. As CO3 mentions, *"there are certainly incentives to implement sustainability either through the country's development authorities or through the municipalities, but this encouragement is verbal support and, personally, I think it is inadequate and unsatisfactory."* However, the results from the voluntary national review conducted by the government on the progress made towards achieving SDGs set forth by the United Nations high-level political forum may bring attention to the action taken by national entities such as the government, private and non-government organisations to fulfil the goals of the 2030 agenda for sustainable development.

Lack of top management commitment to a sustainable future could affect the success of the SBMs. As CO1 puts it, *"the problem is that we need a new integrated structure and the requirement to shift quality and integration will be from all parties in this model and specially those at the top."* Quality of service delivery is likely to improve at a much faster rate if all members engage in project development and communicate freely, regularly and share innovative ideas.

Practitioners from the real estate development reported difficulties in obtaining approvals for sustainable practices from local government agencies. RD4 explains that, *"while the issue is partly a social problem linked to unawareness of the benefits of sustainability, it can affect BM transformations and contribute to negative publicity for the government in areas of housing and infrastructure development."* This attribute is closely related with low research and development. Government institutions and the private sector have been found guilty of not investing adequately in research and development for sustainability practices. As CO3 says, *"one of the important requirements for sustainable transformation is a specialised department in research and development (R&D) and innovation."* Even government institutions, private universities and non-profit organisations could establish learning courses that teach sustainability fundamentals as a part of a larger curriculum. For example, sustainability issues are present in many fields, such as regional planning, environmental consultancy, and agriculture and health assessment, for which firms need knowledgeable resource personnel. Sustainability experts can become members of leading corporations to direct the firms' corporate strategies.

In conclusion, political challenges comprise of factors like inconsistent policymaking for sustainable development issues, changing regulations, lack of a clear definition of sustainability, limited government support, lack of senior management commitment, lack of appreciation from the government procurement system and low research and development on sustainability issues. The government can improve its reputation by engaging sustainability experts with leadership skills to impose best guidelines for sustainable development. As SBMs are still evolving, the government can incentivise HCCs to achieve a higher customer satisfaction score through financial incentives and environmental regulations. The government can change its reputation to become a proactive supporter of sustainable movement by introducing a meaningful change to its policies for the benefit of HCCs, investors and TCs. However, it must provide the required support to HCCs that seek SBM transformations without affecting the economy, investors or consumers. The next part will provide information on the social issues fronting the application of the SBMs.

- **Social Challenges**

The participants explicitly and systematically focussed on social constraints as a main challenge to SBMs application in the HCI. Varying opinions were captured during the interviews and discussions with participants, which have been summarised in the themes, as shown in figures (5-22 & 5-23). The most commonly-cited social challenge that was responsible for the slow adoption of SBM was the unawareness of both stakeholders and end users. This was followed by other social problems, such as lack of trust in partnerships, as consumer behaviour lacked faith in the SBMs. Participants also felt it was hard to change the market drive. HCCs found themselves providing low transparency for partners, which affected their capacity for building opportunities. Similarly, changing the existing BM and introducing acceptance and recognition of sustainability into the business was difficult when addressing social needs.

Name	Sources	Referen...	Created On	Created...	Modified On	Modified By	Color
Social	0	0	9/2/18, 3:53 AM	ADNAN	11/22/18, 2:20 PM	ADNAN	
Unawareness of the...	17	36	9/2/18, 4:16 AM	ADNAN	12/10/19, 3:08 AM	ADNAN	
Attitudes Toward Su...	11	15	9/4/18, 3:02 PM	ADNAN	12/10/19, 3:08 AM	ADNAN	
Hard to Match Cust...	10	16	9/6/18, 2:34 PM	ADNAN	11/22/18, 2:14 PM	ADNAN	
Capacity Building Is...	9	15	9/4/18, 3:09 PM	ADNAN	11/22/18, 2:08 PM	ADNAN	
Lack of Partnership	9	18	9/6/18, 1:51 PM	ADNAN	11/8/18, 3:05 PM	ADNAN	
Culture of (sustaina...	7	7	9/4/18, 3:08 PM	ADNAN	9/7/18, 8:08 PM	ADNAN	
Change Managemen...	6	10	9/4/18, 2:59 PM	ADNAN	11/22/18, 2:18 PM	ADNAN	
Hard to Change in t...	6	10	9/4/18, 3:09 PM	ADNAN	11/22/18, 1:50 PM	ADNAN	
Low Transparency w...	5	11	9/4/18, 4:07 PM	ADNAN	11/22/18, 10:30 PM	ADNAN	
Acceptance and Rec...	4	9	9/9/18, 4:31 PM	ADNAN	11/22/18, 1:51 PM	ADNAN	
Consumer Behaviors	3	6	9/9/18, 4:37 PM	ADNAN	11/23/18, 12:04 AM	ADNAN	

Fig 5-22: Social Challenges

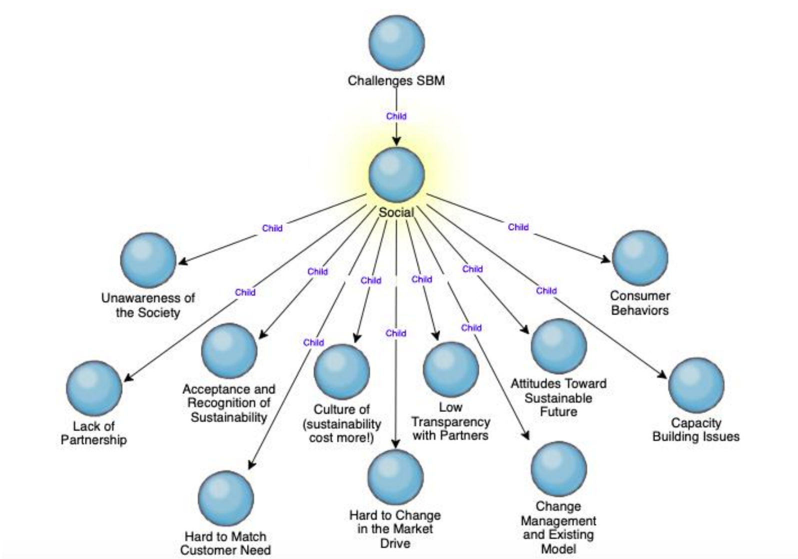

Fig 5-23: Social Challenges

The nature of social problems that affect consumer decision-making or satisfaction levels with SVP is complex to judge, according to the participants. The overall environment surrounding development of SBMs reflected the attitude of the government and private organisations. Absence of standards for sustainability practices in the HCI required environmental clearance. To counter this situation, the social structures, such as top management and affected stakeholders, needed to become more aware of the issues surrounding sustainable practices (Al-yami & Price, 2006; Susilawati & Al Surf, 2011). However, consumer awareness of sustainability benefits also appears to present challenges to the implementation (Taleb & Sharples, 2011; Zhao et al., 2016). There is unawareness among the public agencies and customers regarding SBMs implementation, both in the public and private sector in the country. CS1 states that, *"sustainability-oriented housing business has a clear message and benefits both environment and society. However, there should be a way to increase the awareness to maximise these benefits and overcome this challenge."* Likewise, the application of SBMs should be reflected in social gatherings and increase awareness, across both communities and HCI stakeholders. HCCs use multiple terminologies for the term 'sustainable', as per CO1, to convince consumers. As such, sustainable has been replaced with smart homes or green homes to increase consumers' conviction towards their purchase. However, it is not the best way to bring consumers on-board when terms like green and sustainable have different references. Nevertheless, the idea put forward by CO1 was precise where he said that, "*the aim of each home is to reduce dependence on natural resources or, at least, optimise the use of these resources in a high-quality manner."* This is exactly what SVP aims to achieve – homes that use less and less non-renewable materials and provide social avenues for families at a reasonable price.

HCCs with existing BMs have desperately sought partnerships with government agencies according to CO1, stating that firms wanted to establish, *"partnerships with banks through their social participation."* This means banks or government-controlled financial institutions become strategic partners as lenders to create the increased participation of the community and society. Likewise, partnerships with clean energy companies that support sustainable design and energy-saving principles are needed to improve and learn from construction activities like thermally insulated walls, and save energy by applying sustainable design principles (Bocken et al., 2014; Kurdve & De Goey, 2017). CO2 added that, "… *they pay* *less attention to the benefits they can get by partnering within the network."* However, HCCs must be careful in a competitive environment as not every partner may have the same sustainability agenda or financial bottom line commitment. CO2 added that, *"partners in this field are looking for profit."* This means that partner networks are mostly competitors looking for projects with the aim of achieving a simple profit margin. Those partners would try to monopolise the machinery and labour inventories to control markets and alter the momentum of construction and development.

Satisfying customer requirements according to their lifestyles, professions and preferences was a major challenge for HCCs' SBMs to accommodate. Since it is challenging to match customer needs, HCCs have produced standard module solutions, based on predefined consumer profiles, linking consumer characteristics with available customer segments in a best-fit case. According to Mulliner and Algrnas (2018), rapid urbanisation combined with a growing population is limiting the housing supply in Saudi Arabia, which is facing a significant challenge. HCCs have tried to build large-scale housing solutions to resolve this issue but it was found that such projects resulted in construction of low-quality housing units mostly due to the lowest bidding procurement approach followed by use of the traditional business model by the HCI. Similarly, the researchers were able to prove significant differences in the views of consumers and property practitioners on which housing attributes were considered important. Therefore, HCCs should take note of CO2's view on SBMs, *"the process of producing products is not the problem faced by the traditional model, but what is making it suffer is the failure to meet the customer's needs, which appears obvious in the model because of weak sales and increased complaints from the target group."* CO2 discussed the opportunities that emerged from the unfulfilled need of the consumers, which a sustainability driven BM could target. As acknowledged by CO2, the culture and reputation of high upfront cost firms would have to conduct extensive market research to build products that consumers need; it was understood that such efforts would pay off later as firms would a) hold highly analytical data on consumer preferences, bringing competitive advantage b) open a new market filled with opportunities and c) improve the way they design value offerings.

In some discussions, participants referred to the use of green principles as undesirable from the investor's point of view. As confirmed by CS1, "*they* (referring to government, private and public investors) *have less desire for a sustainable future because of the low demand."* Investor confidence was surprisingly low due to the low demand, unclear laws on sustainability and environmentally-friendly materials. While this view was hard to appreciate, the possible cause of this could be found in Mubarak (2004) cited in Kyriazis et al. (2018), which says that the outward growth of Riyadh and other big cities three decades ago, fuelled by land speculation, could be seen as urbanisation without suburbia. It's obvious that consumers were seemingly unperturbed to be living in traditional housing provided by large-scale housing projects. Thus, it is a challenge for SBMs to be effective without meeting demand and addressing customer needs. In these situations, a SBM should be adopted in a few sustainability-driven projects while controlling urban sprawl through the encouragement of infill development – using sustainable methods. This meant that the growing population would appreciate the quality of SBMs available to consumers. Therefore, HCCs could benefit from empty residential projects by creating value-added services. They could develop the social and environmental structures through partnerships with local municipalities to attract consumers.

One of the challenges identified during the interviews was the lack of employment and scarcity of skilled labour in general. As RD3 said, *"there is not much interest in training the workers and teaching them the latest technologies in construction."* Capacity building issues limited HCCs' abilities to develop sustainable residential projects as they investments were driven by real-estate speculation instead of environmental, economic and social attributes.

Changing a HCC's existing model is difficult, according to RD4, because, *"acceptance of both customers and public government departments for sustainable products appears to be challenging."* This could be correlated to awareness, mentality and culture of government agencies rather than holding sluggish consumer demand responsible for this situation. According to UN3, *"sustainability is a necessity, it is not an option, and it needs to combine efforts at all levels. The transformation has not happened yet. It needs a culture that believes in change. This will affect the housing industry."* As a business engaged in housing development, it was important to predict future challenges that affect BMs by pushing for change to sustainable practices internally and externally. As MH1 puts it, *"the challenge is to change the current BM in all its systems and replace it with systems using sustainable principles in all its activities. It needs culture and awareness."* Al Surf (2013) confirms this concluding, at the end of his study, that lack of awareness lies behind all the challenges relating to application for sustainable housing practices in Saudi HCCIs.

The process with which a HCC manages to generate revenue relies on the external environment as much as it depends on the HCC's internal capabilities. For example, a failed certification for safety can jeopardise the firm's investment in a large residential complex. Similarly, land prices in cities known for their religious and cultural heritage, such as Makkah and Madinah, can drive up real estate prices to an extent making development a high business risk. Perhaps, as mentioned earlier, low domestic oil prices may prevent SBMs from operating in an unsustainable economy. As CO1 said, *"BMs rely on particular external conditions to be called sustainable. Those conditions must match with a thriving economy that is delivering social progress within environmental limits."* The existing model of the economy supported and run by government-funded institutions may create obstacles to changing the oil-driven market policies. Lack of support could stifle the success of application of sustainable theories. As MH2 states that, *"the difficulty here is that we can't pressure the market with new ideas otherwise we will suffer from very high resistance."* The acceptance and recognition of SBM within the HCC itself will not suffice if customers are unable to grasp its significance and fail to apply for new building materials in their homes or energy-saving components due to low technological acceptance. Therefore, a culture of sustainability is driven more from its reputation and application despite costing more than regular products. According to RD3, "*... they (customers) fear that the application of sustainability may create additional costs as sustainability is known to cost more than traditional development methods."*

In summary, the social awareness that could change consumer behaviour and motivate HCCs, investors and developers to drive sustainable efforts has been absent in the culture of HCI. While it is necessary to have discussions on climate change on a global level, in education systems, during conferences and in meetings that take place among senior management of HCCs, it is also necessary to drive cultural change from the bottom-up, such as encouraging new talent by skilling them with knowledge on sustainable practices, and developing and training designers, architects and labour to appreciate the impact of well-planned, low energy and affordable SVPs. Unless every large and small HCC pushes for an increased acceptance of SBM in the Saudi culture and shares the same broad goals of sustainable development, it can be difficult to achieve a SBM transformation. Having a positive attitude to a sustainable future and striving to understand customer needs before undertaking any activity will create an example and the necessary marketing momentum that pushes the culture of social sustainability revolution further into hard-to-reach consumer segments. The following section informs technological and technical challenges as seen by the participants facing application of the SBM in the HCI.

- **Technological/Technical Challenges**

The participants admitted that HCI was sceptical about adoption of technologies and innovative processes, fearing consumer fallback. While most participants cited lack of sustainable practices in the market as a possible reason, others believed slow rates of innovation presented technological challenges. Lack of methods for assessing sustainability and absence of sustainable value chains were considered problematic. This includes poor recycling infrastructure, lack of information about market demand and difficulties with getting approvals for use of recycled materials in the construction industry. HCCs with limited financial capital were not keen on investing in ICT platforms and feared sharing sensitive business information with partners, fearing ethical issues. Thus, in some ways, HCCs have been unable to leverage the best technological advancements, which would have improved their supply chain capabilities and communication between partnering networks. The list of technological challenges is presented figures (5-24 & 5-25) below:

Name	Sources	Referen...	Created On	Created...	Modified On	Modified By	Color
Technical & Technologi...	0	0	9/2/18, 3:54 AM	ADNAN	11/22/18, 10:29 PM	ADNAN	
Lack of Sustainabilit...	14	17	9/4/18, 3:39 PM	ADNAN	11/22/18, 2:27 PM	ADNAN	
Low Innovation in th...	14	20	9/4/18, 3:58 PM	ADNAN	12/10/19, 3:08 AM	ADNAN	
Low Sustainable Pra...	14	23	9/2/18, 4:15 AM	ADNAN	11/23/18, 12:22 AM	ADNAN	
Lack of Sustainable...	9	16	9/4/18, 3:58 PM	ADNAN	12/10/19, 3:08 AM	ADNAN	
Lack of Recycling Fa...	7	12	9/4/18, 3:59 PM	ADNAN	11/8/18, 3:47 PM	ADNAN	
Lack of Consideratio...	6	8	9/4/18, 4:21 PM	ADNAN	11/23/18, 12:23 AM	ADNAN	
Difficulties in Sharin...	3	3	9/4/18, 3:56 PM	ADNAN	11/23/18, 12:24 AM	ADNAN	
Hard to Approve ne...	3	4	9/7/18, 12:17 AM	ADNAN	11/23/18, 12:23 AM	ADNAN	
Lack of Information...	3	3	9/4/18, 3:56 PM	ADNAN	11/22/18, 2:11 PM	ADNAN	
Lack of Information...	3	8	9/9/18, 4:52 PM	ADNAN	11/23/18, 12:23 AM	ADNAN	
Low Level of Comm...	2	2	9/4/18, 4:06 PM	ADNAN	11/22/18, 10:25 PM	ADNAN	
Lack of Comprehen...	1	4	9/6/18, 1:45 PM	ADNAN	11/22/18, 10:24 PM	ADNAN	

Fig 5-24: Technological and Technical Challenge

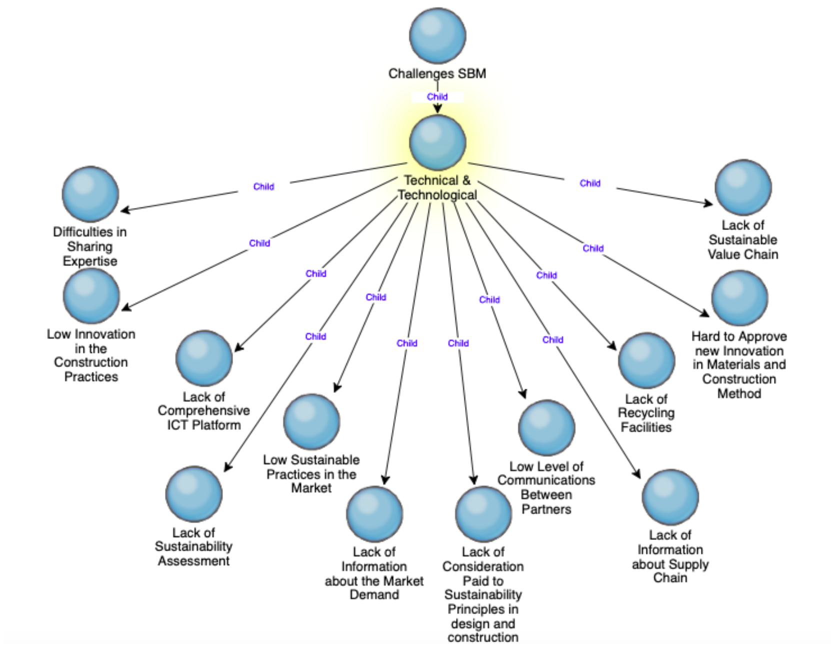

Fig 5-25: Technological and Technical Challenges

Emergence of new and innovative technologies to optimise VC in the SBM phases, such as in planning, design, construction and operations phases, created, mixed emotions among the participants. Essentially, compatibility issues emerge when designers want to use new software and enhanced modelling techniques for existing or old projects to learn from their mistakes and improve their designs. Likewise, software design is critical for improving the efficiency of the SBM processes. As CO1 explained that, *"using renewable energy in the model offering, we need a competent authority to communicate with suppliers and make sure that the maintenance work is set up correctly and that the company has spare parts for commonly worn out items. Otherwise, installing and applying the renewable energy idea would be a financial waste."* Adoption of SBM is appreciated in cases where it makes financial sense. As RD3 said, *"no company believes in placing environmental issues as their main goal. They, in fact, are interested in profitability as a first option and they use environmental solutions as an option if these issues, for example, show a sense of reducing costs."* Clearly, HCCs are willing to make extra effort to adopt environmentally sustainable practices when it makes financial sense – something that the government can incentivise through appropriate policymaking. Similarly, environmental sustainability efforts can spill over into social and economic sustainability challenges.

The low rate of innovation in construction practices in past years has limited adoption of efficient methods of construction. According to RD1, *“there is a lack of convenient technical solutions in the market for sustainable value creation.”* Although inventions in materials engineering, design and automation have evolved during the last decade; for example, 3D printing and computer-aided design, they are not sufficiently disruptive to replace traditional models of construction. As RD2 said, *“we have seen new practices in building homes, such as off-site construction or even building homes using 3d printing technologies; and what happened later? …. Nothing!… We need something disruptive to the market so we can build new markets and build demand based on it.”* While sustainability experts from practitioners and leaders in the HCI have sought alternative models, such as off-site construction (Aburas, 2011; Wei Pan & Goodier, 2012), vernacular construction technologies (Alrashed, Asif & Burek, 2017), 3D concrete printing technology (Weinstein & Nawara, 2015), BIM implementation (Sodangi, Salman & Saleem, 2018), solar energy and energy efficiency integrated technologies (Mokheimer, Dabwan & Habib, 2017; Sweetser, 2012) and ICT adoption (Duyshart et al., 2003), these are small examples of technological innovation in the housing construction industry that need further examination. The participants were of the view that technological challenges were more prominent than challenges presented in, for example, social, economic and political areas; however, the social and political challenges are more complicated to solve. As RD3 said, *“Although we see limited innovation in housing practices, the consumers are not ready for these new innovations and their acceptance will need time and evidence.”* Low rates of innovation in construction practices, as descried also by Morgan et al. (2014), indicates the complexity of this field and, perhaps, explains why institutions are apprehensive about developing knowledge on sustainability practices and studies in the HCI.

The sustainability assessment model borrowed from developed countries does not account for the problems of implementation of sustainability practices in the Saudi Arabia HCI. For example, the European standard uses a methodology that calculates energy ratings based on the detail level of the model and confidence in input data. However, such standards will not work elsewhere unless they can handle uncertainty in the model detail and input parameters. Instead, the sustainability assessments and rating system should focus on the organisation’s BM to maximises the benefits. As MH1 said, *“the most challenging thing we are* *experiencing in implementation of sustainability is building a beneficial and clear rating system or evaluation/assessment model, not for the house scale, but should be oriented towards the organisation's model* (meaning the BM).*"*

The benefits of technology adoption can outweigh risks and cost. HCCs seeking SBM transformation must use ICT tools for improving communication and efficiency within and outside the organisation. For example, ICT technologies will enhance how HCC communicate with their local supply chains, track inventories, place orders and manage payments, as asserted by Duyshart et al. (2003). However, CO2 commented on, "*limitation of mature green and effective supply chain."* There is essentially a lack of green or local suppliers that value sustainability and provide the necessary raw materials for construction practices. Additionally, lack of recycling facilities creates an unpredictable supply chain that could halt the VC and KR, leading to financial delays and financial loss. This fact has also been asserted by Al Surf (2013). As RD2 puts it, *"the facilities that are concerned with construction waste in the country are scarce, or non-existent."* Therefore, firms have limited incentive to minimise waste in the construction phase at present.

According to the developers, HCCs that fail to use computer applications and software for estimation, design and planning eventually consume higher amounts of materials, water and energy during the construction, operation and maintenance phases of projects. Failure to consider adoption of sustainability principles in design and construction affects the financial bottom line. HCCs were unable to carry out independent studies or find published data on consumer characteristics in the markets, according to RD2. There could be high risks in using unverified data on consumer needs and when starting projects. The safe approach to understanding consumer needs is to carry out independent, self-funded studies using technology as a relatively low-cost option to gather information.

Another challenge cited by practitioners was the difficulty to approve any new innovations in the HCI Saudi market. Due to the rigid nature of regulations, it can be years before a new innovation is accepted. As discussed earlier, ICT integration will enhance a firm's efficiency as multiple technical systems can communicate and exchange information. CO1 pointed out, *"the integration of technical systems with each other should be a priority"*, going on to explain that waste should not exceed five percent of the total project value. Creating a smooth flow of information will help HCCS share timely information with experts so that they can track progress, review and correct problems before they present a financial risk for the firm. Most suppliers work in an offline mode, which makes it hard to know the real-time prices of raw materials. CO3 stated that, "*an online application or website is needed to aggregate those suppliers, especially the local ones.*" By adding and updating information about the market, HCCS can improve their decision-making skills and allow local suppliers to share prices that reflect current market conditions. Participants acknowledged the benefits of checking prices online rather than visiting the location. According to RD1, *"there should be a network or platform where all materials in the market are available to enable purchase and supply when there is a building permit."*

In summary, benefits arising out of technology acceptance have several dimensions. Based on responses of the participants, it was possible to correlate use of ICT as a facilitator of communications bringing HCC closer to their partner networks, investors and consumers. Technologies such as 3D visualisation allowed the designers to draw designs and show their three-dimensional structures to consumer segments for adjustment to consumer needs. Technological innovations have proved beneficial in almost every field of housing construction; starting from planning tools, project management tools, design software, communication technologies and platforms for data exchange and integration, construction technologies, material technologies, recycling and waste management technologies, maintenance and operational management processes. The issues with technological acceptance were due to the lack of sustainable practices in markets according to the participants. Slow rates of innovation in the construction industry, poorly developed assessment standards at BM scale, sustainable value chain and recycling facilities explain the reluctance among firms, government agencies and consumers to accept a SBM and adopt sustainable construction in the HCI. The next section will address the benefits of adopting SBMs.

5.4.6 Benefits of SBMs

A SBM takes total control of the consumer market by offering a value proposition built upon product innovation and the firm's effective management skills in identifying the best SVP for the TC. Benefits of a SBM are divided into economic, environmental and social dimensions. The business delivering this value, which converges on the three benefits of good pricing, low environmental impacts and community development, require immense support from participating groups, such as local governing bodies, value chains, environmental impact assessment groups, banks and consumers. As everyone participating in the process benefits, the model is considered sustainable. These benefits are represented in figure (5-26) below.

Name	Sources	Refere...	Created On	Created...	Modified On	Modified By
Benefits of SBM	0	0	9/10/18	ADNAN	Today, 1:17 AM	ADNAN
Economic	0	0	9/10/18	ADNAN	Today, 1:07 AM	ADNAN
Environmental	0	0	9/10/18	ADNAN	11/15/18, 4:24 PM	ADNAN
Social	0	0	9/10/18	ADNAN	11/14/18, 1:56 PM	ADNAN

Fig 5-26: Benefits of SBMs

- **Economic Benefits**

Participants were convinced about the attractiveness of a SBM for the HCI. Although participants had a diverse set of background and experience, they were confident about the economic benefits of a SBM for their firms, consumers and partners. Overall, the unawareness and high cost of sustainable products in the market are the main reasons for its low demand. However, participants believed government support and grants would alleviate this and help HCCs introduce product innovation in SBMs and introduce new and competitive markets. This is a new and niche business opportunity, according to several participants. Saving the HCC's own financial capital to invest in improvement and reorganisation of its capabilities is a major economic benefit for the firm creating and delivering the SVP. Future ready products that combine the latest technologies, from design to construction, at reasonable prices is a strong economic benefit for consumers. HCCs that continue product innovation processes for its consumers over the entire project lifecycle have remarkable economic opportunities that transform into sustainable revenue channels. To varying degrees, HCCs can generate these economic benefits for their HCCs, for the government in its participatory role as a financial stakeholder, and for the consumer who pays a competitive price to obtain that SVP. The economic benefits are listed in figures (5-27 & 5-28) below.

Name	Sources	Referen...	Created On	Created...	Modified On	Modified By	Color
New and Niche Busi...	15	27	9/10/18, 12:34 PM	ADNAN	11/23/18, 12:51 AM	ADNAN	
Future Ready Produ...	13	19	9/10/18, 1:51 PM	ADNAN	12/10/19, 3:08 AM	ADNAN	
Government Suppor...	13	31	9/10/18, 12:35 PM	ADNAN	12/10/19, 3:08 AM	ADNAN	
Saving Money and R...	13	22	9/10/18, 3:17 PM	ADNAN	11/23/18, 12:52 AM	ADNAN	
Affordable Prices	12	18	9/10/18, 2:59 PM	ADNAN	11/13/18, 5:25 PM	ADNAN	
Assist the Housing...	12	16	9/10/18, 2:26 PM	ADNAN	12/10/19, 3:08 AM	ADNAN	
Increase Business P...	11	16	9/10/18, 12:35 PM	ADNAN	11/13/18, 5:20 PM	ADNAN	
Growing Demand for...	8	17	9/11/18, 5:02 PM	ADNAN	11/13/18, 5:19 PM	ADNAN	
High Market Value	8	17	9/10/18, 12:35 PM	ADNAN	11/13/18, 5:19 PM	ADNAN	
Improve Developers...	8	11	9/10/18, 12:36 PM	ADNAN	11/13/18, 5:21 PM	ADNAN	
Competitive Advant...	7	9	9/11/18, 5:23 PM	ADNAN	11/13/18, 5:28 PM	ADNAN	
Attractive for Proces...	6	7	9/10/18, 12:36 PM	ADNAN	11/13/18, 5:22 PM	ADNAN	
Compatible with the...	5	8	9/11/18, 5:22 PM	ADNAN	11/15/18, 5:23 PM	ADNAN	
Long-Term Growth	5	8	9/12/18, 11:41 PM	ADNAN	11/13/18, 5:22 PM	ADNAN	
Mitigating Risks	5	5	11/14/18, 2:07 PM	ADNAN	11/23/18, 1:06 AM	ADNAN	
Change in Consump...	4	5	9/11/18, 1:34 PM	ADNAN	11/23/18, 12:55 AM	ADNAN	
Multiple Income	4	9	9/13/18, 5:40 PM	ADNAN	11/13/18, 5:28 PM	ADNAN	
Attract International...	3	3	9/13/18, 6:57 PM	ADNAN	11/23/18, 12:55 AM	ADNAN	
Smart	1	2	9/13/18, 6:52 PM	ADNAN	9/13/18, 6:53 PM	ADNAN	
Wins in Competition	1	2	9/13/18, 5:39 PM	ADNAN	11/13/18, 5:23 PM	ADNAN	

Fig 5-27: Economic Benefits

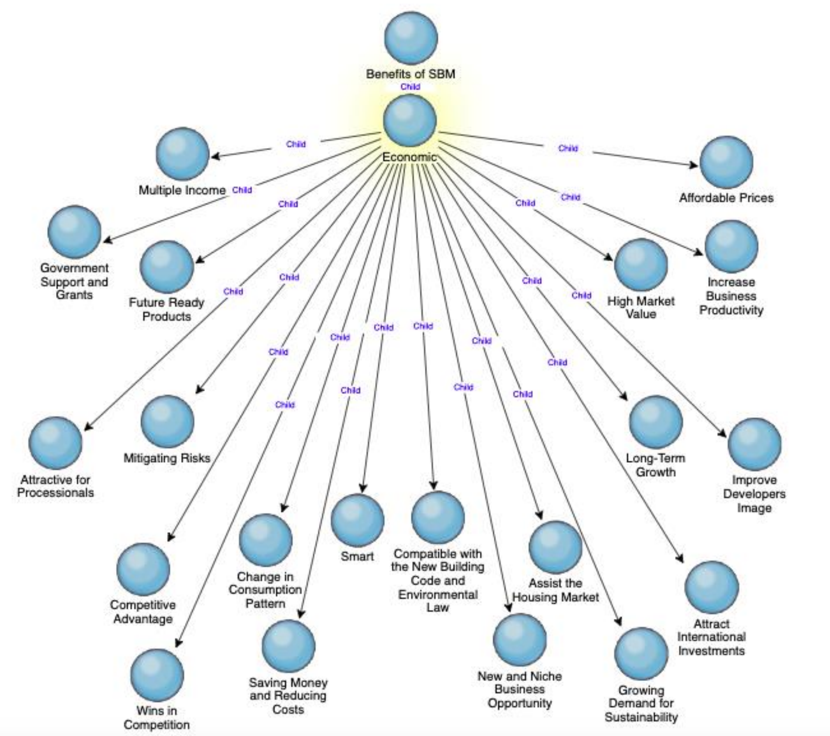

Fig 5-28: Economic Benefits

Developing SBMs in Saudi Arabia was perceived as a turning point for the HCI. Participants reported economic benefits arising from SBMs activities. This section reports on those economic benefits for people involved in the project lifecycle. In general, any economic benefit arising from a SBM is shared by developers, investors and consumers. For example, *"saving money and reducing costs is a target for the consumer, state and firms alike* (MH1)*."* Environmentally oriented models for the construction industry show money saving as a benefit for both the supply and demand sides. Additionally, individual benefits, such as reasonable pricing, mainly supports the end user, whereas HCCs enjoy competitive advantage originating from their sustainable efforts, thus adding economic value from recognition of the brand (Mokhlesian & Holmén, 2012). Similarly, each member engaged in sustainable practices receives benefits from individual or combined efforts.

Some participants felt government agencies were in a better position to obtain international financial support and grants by channelling sustainable development funds to municipal programs and initiatives. The Saudi government could make this achievable by seeking support from HCCS with access to sustainable sites and funds. The HCCs, in turn, would obtain faster approval for projects and compliance certifications from local government authorities. According to CO3, *"the Saudi government was keen to invest in large projects, such as King Abdullah Financial Centre and KAUST University and KAPSARC for energy research and other strategic projects."* Such projects receive internationally renowned sustainability certifications, thus acting as trendsetters for firms seeking to engage in sustainable practices (Abuzeinab, 2015; Mokhlesian & Holmén, 2012). The new and niche business opportunities for the developers meant they could either continue with traditional methods of development and fall out of the government-sponsored schemes or rethink their BMs to take a sustainable approach. As RD3 explained that, *"such a model benefits from being in a niche, specialised market that is specific to the product or service and not comparable with any other business. It makes the three bottom lines a priority."* Therefore, HCCs adopting BMs respecting economic, environmental and social parameters will slowly transition from a new and largely unknown segment to a mature, recognised and accepted phenomenon in the Saudi HCI. SBMs would motivate HCCs to work within a unique set of priorities as opposed to a traditional residential development company. As an indicator of this vast business opportunity, MH1 stated that, *"the Saudi HCI data indicates that there are more than 160 projects in the Kingdom with more than 14 million square metres of buildings that are required to be sustainable and green. All aim to bring direct benefits to the available resources of energy, water and building materials, enhance the efficiency of recycled and environmentally-friendly materials, reduce waste of energy, reduce harmful gases by 30 per cent and increase water by 40 per cent."* Therefore, businesses that value financial rules over environmental and social principles would eventually find themselves unable to create, deliver and capture value, since their firm's business model would be designed to recognise only financial benefits (Abuzeinab, 2015; Aho, 2013).

The economic benefits of a certified SVP with energy efficient appliances and a smart design outweighs its premium price. As RD1 mentioned, *"the financial offer of these products is reasonable and in line with the financial capacity of the target group."* It was easy to convince customers who recognised the financial savings they would generate by living in green buildings over a period of time (Mokhlesian & Holmén, 2012). However, they needed assurance from the project developers in the form of long-term maintenance agreements and contracts that covered all expenses in the event of product failure. As customers received long-term value derived from carefully planned, designed and executed SVPs, they could in turn maximise this value by behaving responsibly in their living space, using less energy and reporting issues to maintenance agencies in a time-bound manner.

Practitioners working within the HCCs said that capturing value may take years in an increasingly competitive landscape. For example, HCCs using traditional building and selling may be unable to find investors to cover the costs of their entire BM. This would lead to longer waiting periods for customers as HCCs would have to generate investments from customers to complete construction activities before handing over SVPs. As the SBM is yet to enter the mainstream of HCI, the growing demand for sustainable products can be satisfied if HCCs are able to build sustainable products on time and reduce construction costs with each project lifecycle. As CO3 said, *"I believe that the strong economic benefit is the great market value of the products."* This is primarily because sustainable products retains their value over time whereas traditional ones suffer from depreciation in value (Partee, 2009).

Similarly, SBMs could provide an alternative for people dis-satisfied with existing models and wanting to improve their standard of living without using up vast amounts of non-renewable resources. According to UN1, referring to the SBM, *"it assists the housing market by reducing sources used and, at the same time, eases shortages."* One of the self-driving economic benefits of the SBM highlighted by the developers is how it affects business productivity. As HCC implemented SBM, for its offerings, operations, selection of materials and in-profit formula, it brought closer to socio-environmentally friendly production. Once these products were out in the market, they could generate publicity and attract investors, consumers and partnering firms. This improved not just the developer's image as a leader in sustainability practices, but it also created respect for SBMs in the community. As RD3 put it, *"implementing such a model (meaning the SBM) would be a turning point in the industry, contributing to improvement in the image of developers and portraying them as being interested in human issues and the environment."* When HCCs find solutions requiring a change from their philosophy of profitability to that of shared risk and revenue over the product life-cycle, this will provide the vital experience needed to design SVPs according to the capabilities of the HCC and its partners. Markets are generally looking for firms that can enter new markets and create products and services that consumers want and are willing to pay more than the market price for (Zhao et al., 2017). As MH2 additionally sums up, HCCs *"will have the experience and network needed to develop sustainable products with a value that is difficult to compete with."*

A direct and clear financial benefit arising from the adoption of SBMs is the HCC's ability to generate income from multiple sources, as asserted by professionals and practitioners in the HCI. As UN1 said, *"the revenue model does not depend on one source of income"*, and as CO3 mentioned, *"I also think, through the R&D and innovation part, we can generate a new source of income not found in the traditional business model. For example, income will be money in exchange for courses or consulting for emerging companies."* This view was repeated in discussions with several other participants, as they believed the SBM lets HCC earn from more than one channel. The additional sources of income using the SBMs is additional to its primary revenue stream (i.e., home sales) thus generating sustainable income for the HCC and its partners. In some ways, according to UN1, *"the idea here is not only having a multiple income but also a new source of income that the traditional model doesn't have or even consider*." The new sources of income would come from offering consultancy to other HCCs that want to join the new business opportunities offered in the sustainable orientation market.

As observed by some participants, HCCs that adopt a SBM are likely to obtain faster land clearance approval from the government compared with their competitors. This, among other economic benefits, would make a good business case for implementing the Saudi building code and complying with environmental laws. Practitioners believed that the commitment of a HCC to making successive investments to improve its workforce and train them in sustainable practices would prove beneficial for them in the long term. Explaining this idea, CO1 pointed out that, *"investment in the workforce and in the design team in terms of specialised training courses in the field may cost more but in the long run will provide technological and human capabilities at highest level."* Several participants felt social and environmental dimensions needed rethinking since HCCs organised their capabilities to operate on purely commercial terms. However, change in consumption patterns that reflected the shift of the population and government support was yet to be seen in the HCI, according to the contractors. CO2 shared this idea: *"the shift of the economy to sustainable models is an ideal solution for dealing with environmental and community issues through the creation of high-quality community environments."* This model has the momentum to create job opportunities for professionals to share new and innovative ideas in every phase of construction (Moschetti et al., 2018). MM1 continues that, "*talent acquisition and retention represent one of the most important factors for a company to remain competitive and successful for the long-term."* Participants believed that firms able to develop a sustainability-conscious workforce and attract talents would be successful in future (Abuzeinab, 2015; Zhao et al., 2017). This meant less risk in the HCI of problems requiring intervention. HCCs' ability to recognise and mitigate risk was critical for business success and growth. As RD2 said, *"predicting risks and what will happen in the market is important. We have to assess and predict risks during the project or before we start a project"*.

SBMs have a propensity for attracting international investments as the Saudi economy moves from wasteful construction practices to resource-saving methods. However, HCCs need to utilise this financial support from local and international partners in a timely manner since the educated consumer group will look to buy from companies that respect the environment and design homes suited for community building. RD6 makes the point that, *"the country has started to become advanced and interested in the well-being and health and quality of life of the community."* Another economic benefit of a sustainability-oriented BM is that each SVP adds to the total sustainability experience of the company, allowing it to work with greater efficiency in improving quality of life for its consumers. The culture of environmental awareness in schools, universities and offices of the benefits of sustainability when solving problems is likely to create an educated society.

Economic benefits, such as opportunity to save cost through tax rebates, will arise under SBMs implementation. HCCs can source products locally and support indigenous suppliers of raw materials to reduce transportation costs. The participants believed this type of financial model would improve over time allowing HCCs to experiment with value chain upgrades. This approach should be complemented with pro-sustainable policies for land use, energy consumption, building materials and labour. According to CO1, *"those who practise sustainability in their businesses will have the benefits of obtaining tax-free resources in the future to finish projects."* Therefore, a SBM can bring many economic benefits for firms engaged in SBM practices, as discussed above. Besides financial benefits, a SBM creates multiple sources of income through the long-term participation of the public and improves brand value and the skill-set of the workforce engaged in the value creation development. Consumers can purchase SVP due to reasonable pricing, as the investment risk is shared by stakeholders, such as local and international sustainability development agencies.

However, HCCs transforming to a SBM can generate many benefits for the HCC besides supporting the economy. The next section describes the benefits of pursuing the SBM for the recovery of environmental losses that occur following rapid urbanisation and growth of economies.

- **Environmental Benefits**

As SBMs offer better value to their consumers and HCCs create value, they also generate benefits in the form of reduction of environmental drain due to housing construction and management activities. As HCCs seek sustainability, they use product innovation that matches customer expectations with the most efficient environmental standards on energy and water usage, waste generation and utilisation, carbon footprint and use of limited materials of construction. The SBM provides environmental benefits for its consumers as a value that BMs of competing HCCs cannot create, lacking the right set of capabilities. The list of environmental benefits is presented in figures (5-29 & 5-30) below:

Name	Sources	Referen...	Created On	Created...	Modified On	Modified By	Color
▼ Benefits of SBM	0	0	9/10/18, 12:32 PM	ADNAN	11/23/18, 1:17 AM	ADNAN	
▶ Economic	0	0	9/10/18, 12:34 PM	ADNAN	11/23/18, 1:07 AM	ADNAN	
▼ Environmental	0	0	9/10/18, 12:34 PM	ADNAN	11/15/18, 4:24 PM	ADNAN	
Product with High Ef...	15	29	9/10/18, 12:38 PM	ADNAN	12/10/19, 3:08 AM	ADNAN	
Saving the Country...	15	24	9/11/18, 3:57 PM	ADNAN	12/10/19, 3:08 AM	ADNAN	
Reduce the Amount...	10	15	9/10/18, 3:02 PM	ADNAN	11/23/18, 1:15 AM	ADNAN	
Support Low Carbon...	9	15	9/10/18, 3:01 PM	ADNAN	11/16/18, 4:55 PM	ADNAN	
Sustainable and Gre...	8	12	9/10/18, 12:37 PM	ADNAN	11/13/18, 5:39 PM	ADNAN	
Reusing Materials	6	8	9/10/18, 5:06 PM	ADNAN	12/10/19, 3:08 AM	ADNAN	
Support Eco-Friendl...	4	4	9/13/18, 4:39 PM	ADNAN	11/16/18, 4:20 PM	ADNAN	
Enhancing Biodivers...	2	4	9/10/18, 3:04 PM	ADNAN	11/13/18, 5:39 PM	ADNAN	

Fig 5-29: SBMs Environmental Benefits

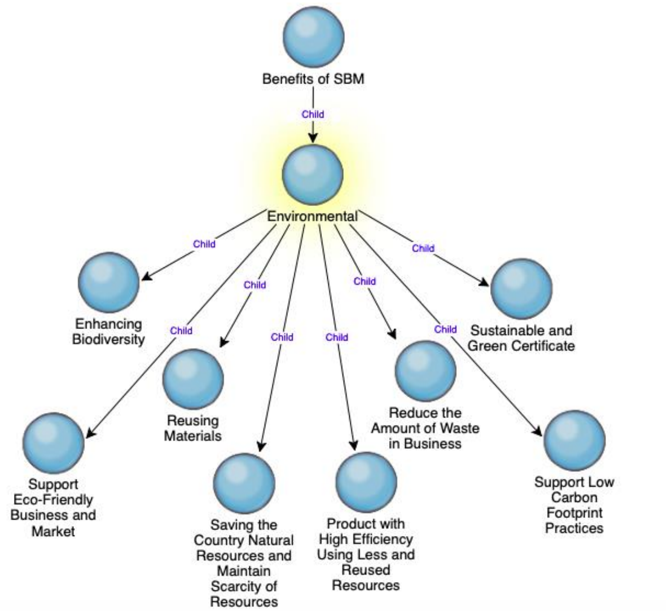

Fig 5-30: Environmental Benefits

The participants believed SBMs could offer environmentally oriented benefits to HCCs involved in the HCI. The environmental value would also benefit conscientious investors interested in sustainable businesses and educated consumers concerned about their carbon footprint. Despite the participants' diverse backgrounds, there was consensus on the benefits of SBMs, starting from the developer to the consumer. These benefits are summarised as follows: demonstrating sustainable product environmental efficiency, saving natural resources, construction waste reduction, low carbon footprint benefits, sustainability certifications, biodiversity contributions and eco-friendly business benefits. The next section describes each theme and reports on the responses made by the participants.

SBM requires a committed workforce and a network of local green suppliers and partnering firms with the same development goals. HCCs can work together to design products that use renewable energy and waste from other industries by low-cost procurement and building quality products that pass international standards. Refurbished waste items can be transported from an out-of-construction site at a low cost. Participants reported unethical and rampant misuse and wastage of energy and water. not only during design and construction cycles, but also throughout the building use. Therefore, sustainability in a real sense is measured by the efficiency of resource utilisation and the model's ability to match consumer needs with innovative SVPs that turn into worthy solutions. For example, Saudi Arabia receives an average of 100 millimetres of rainfall each year; some parts receiving less than 40 millimetres. Also, Saudi Arabia generates most of its drinking water from saline sea water following desalination, which consumes large amounts of energy and oil (Asif, 2016). Therefore, water conservation is a critical success factor for the success of SBMs in the Saudi Arabia HCI. In this regard, MM1 confirmed that, *"implementing sustainability in the business reduces costs and improves efficiencies as we saw many case studies in HCCs globally and in Saudi where sustainability initiatives are helping the bottom line by driving operational efficiencies that root out excess energy use and other forms of waste."* A typical example of efficient water utilisation is investment in rainwater harvesting for drinking, cleaning and cooking. This water is recycled through natural processes for use in toilets and bathrooms and is flushed into the ground for plants and trees in the community. The last stage of water consumption, i.e., landscaping, is the fourth use of the same natural resource. Thus, SBMs that demonstrate and improve efficiency of every natural resource will be sought by HCCs. As UN1 pointed out that, *"using the sustainable model will provide a drop in the energy used in the process of producing housing projects and also in the energy efficiency provided by the product."* SBMs make full use of site design, solar energy, natural light and ventilation. Previous studies, such as Taleb & Sharples (2011) and Al Surf et al. (2014) found that sustainable designs can learn from the traditional values of architecture and urbanism embedded in the Saudi culture. Participants strongly believe that SBMs in the HCI can save energy, water and carbon at the time of construction as well as during its lifecycle.

Saving the natural resources of the country and securing its natural wealth should concern every individual residing in the country, according to the participants. As CO3 confirmed that, *"global reports indicate declining rates of natural resources, such as water and energy,* *and with the rise of the industrial revolution negatively affecting the world, sustainability oriented businesses will significantly help to save the country's natural resources."* Similarly, HCCs developing SBMs would have to plan the SVP (e.g., housing units) without disturbing the environmental habitat of the site. Thus, project developers must be capable of visiting the site often to test sustainable solutions with the help of experts to reduce the amount of waste in construction and embed building design and construction activities along with the natural landscape. Waste generated from construction sites should be used preferably within the project or in nearby construction sites to reduce carbon footprints. Talking about reducing waste, RD1 made the point: *"the amount of waste within the project will drop when applying the sustainable model as there will be, in future, specialised green companies that will work as partners to buy and recycle these materials."* HCCs seeking SBMs will need to find green partners that can convert waste into reusable products through blue economy theory. The efficiency with which firms can achieve this task depends on the internal capabilities of the firms and their partners.

Supporting low carbon footprint activities is closely related to a HCC's performance and profits. As Saudi Arabia accounts for a higher carbon footprint than the world's average, for various exogenous reasons, *"supporting sustainable practices through design and development would benefit the environment and contribute to a company's performance (RD3)."* The credibility of sustainability seeking firms would improve through the delivery of environmentally friendly, reliable and long-lasting solutions, demonstrated by their products and services. Therefore, such HCCs would be recognised as sustainable leaders across the industry and attract like-minded firms, investors and consumers. UN1 responded to this view advising, *"promote low-carbon activities by creating new values with the capacity to address climate change and the scarcity of resources."* According to participants, reducing a consumer's carbon footprint is primarily changing consumer views, attitudes, motivations and behaviour to low-energy applications. Contractors and developers maintained that once the resource-saving mechanisms are in place, it would not take much to maintain these systems.

Receiving sustainability certification is another benefit arising from pursuing sustainability practices. As building construction results in vast amounts of atmospheric emissions and waste during construction, occupancy, renovation, repurposing and demolition, these facts have prompted the creation of sustainable building standards, certifications and rating systems that aim to reduce the impact of building on the natural environment through sustainable design. LEED is a prominent rating system for existing buildings and entire residential projects to fulfil the growing interest and demand for sustainability practices in the HCI. LEED certification, along with other noteworthy environmental rating mechanisms, such as BREEM, United States Green Building Council (USGBC) and Green Building Initiative (GBI), could improve the credibility of firms delivering sustainable solutions to the Saudi population. This would sustain the business model of HCCs and put them in the much-needed public eye. Besides creating financial benefits by creating multiple revenue streams, such as government grants, green project investment and consumer sales, sustainability certification is a must for SBM outcomes. As RD2 puts it, *"these sustainable models produce certified housing products with sustainability certificates that automatically raises the value of these products and maintains their value in the market over time."*

SVPs that work alongside environmental laws and provide housing that can be sustained by itself to a large extent, attracts and enhances the biodiversity of the project site and its surrounding regions. For example, wet municipal waste can be used for compost and biogas production. Also, environmentally friendly housing design attracts natural wildlife from surrounding areas, contributing to the project's green image. As CO1 said, *"one of the benefits of being a contributor to the enhancement of the biodiversity in the built environment is the opportunity to help and support the ecosystem to maintain itself."* The application of traditional designs infused with modern engineering concepts creates comfortable living spaces and sustains an eco-friendly supply chain. Therefore, SBMs will allow HCCs to work with environmental constraints, which will be a learning curve for the firm. Project certifications from internationally accepted organisations would bring credibility to the HCC's SBM.

In conclusion, this section has provided the multiple environmental benefits arising from SBMs that reach out to the HCCs, green investors and likeminded consumers. In any case, the benefits to the environment alone should make a strong business case for pursuing SBMs. However, any SVP offer is incomplete unless it addresses the social needs of the customer.

Therefore, the social benefits arising from SBMs, as anticipated by the participants, are discussed in the following section.

- **Social Benefits**

SBMs provide social benefits for its customers through a SVP along with economic and environmental upgrades. Nearly all the participants were confident about the social benefits attached with SBMs, such as improved quality of life. In their view, high quality SVPs with the option of customisations and flexibility to choose its features, thanks to innovation in the construction phase, made an appealing SVP for the customers. Participants found SBMs could provide social benefits for consumers by opening new markets and creating jobs, improving safety through public participation and enhancing social interactions. Public participation, according to a few participants, is placed at the centre of business relations. SBMs would make HCCs more accountable to the public as HCCs try innovative technologies that promote community-based living. This would be an opportunity for HCCs to design and test new BMs, keeping the three sustainability pillars at the centre of discussion with consumers. The social benefits, according to the participants' responses, are listed in figures (5-31 & 5-32) below.

Name	Sources	Referen...	Created On	Created...	Modified On	Modified By	Color
Benefits of SBM	0	0	9/10/18, 12:32 PM	ADNAN	11/23/18, 1:17 AM	ADNAN	
Economic	0	0	9/10/18, 12:34 PM	ADNAN	11/23/18, 1:07 AM	ADNAN	
Environmental	0	0	9/10/18, 12:34 PM	ADNAN	11/15/18, 4:24 PM	ADNAN	
Social	0	0	9/10/18, 12:34 PM	ADNAN	11/14/18, 1:56 PM	ADNAN	
Improve People Quality of Life	16	36	9/10/18, 12:38 PM	ADNAN	12/10/19, 3:08 AM	ADNAN	
Customer satisfaction	11	13	9/11/18, 2:48 PM	ADNAN	11/16/18, 11:27 AM	ADNAN	
Ethical Business	10	15	9/10/18, 2:58 PM	ADNAN	11/13/18, 5:45 PM	ADNAN	
Opining New Jobs Opportunities	9	10	9/10/18, 12:38 PM	ADNAN	12/10/19, 3:08 AM	ADNAN	
High Customized and Flexible Pr...	8	14	9/10/18, 2:31 PM	ADNAN	11/13/18, 5:45 PM	ADNAN	
High Quality Products	8	19	9/10/18, 3:07 PM	ADNAN	11/14/18, 1:28 PM	ADNAN	
Increase Safety Among the Envir...	5	5	9/10/18, 12:38 PM	ADNAN	11/13/18, 5:49 PM	ADNAN	
Enhance Social Interaction	4	8	9/10/18, 3:24 PM	ADNAN	11/13/18, 5:46 PM	ADNAN	
Supporting Universal Accessibility	3	3	9/11/18, 1:14 PM	ADNAN	11/13/18, 5:50 PM	ADNAN	
Increase Public Participation	2	4	9/13/18, 4:58 PM	ADNAN	11/13/18, 5:49 PM	ADNAN	
Support Research and Innovation...	2	3	9/13/18, 5:02 PM	ADNAN	11/23/18, 12:58 AM	ADNAN	

Fig 5-31: SBMs Social Benefits

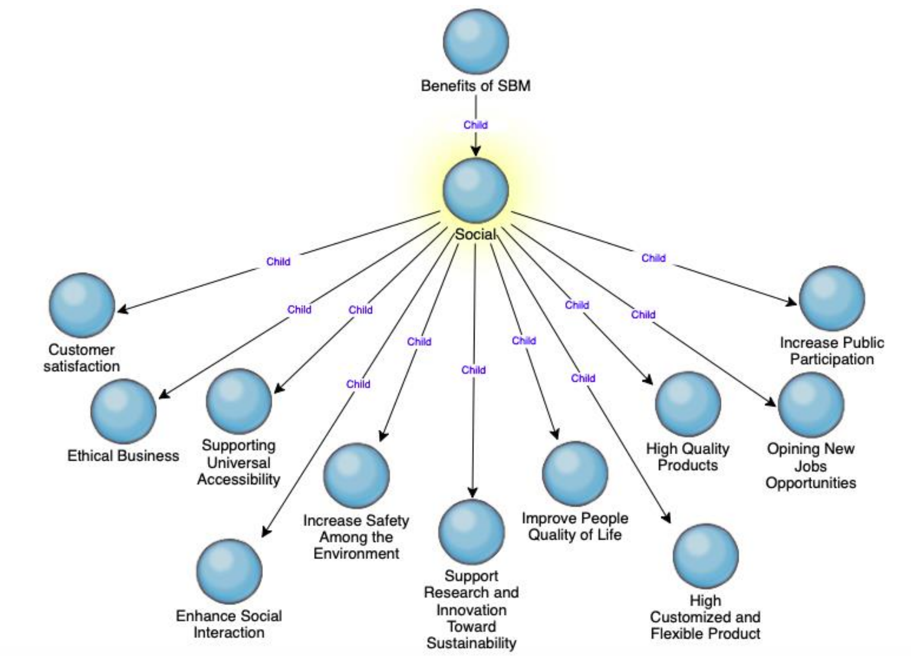

Fig 5-32: Social Benefits

The benefits arising from a model that carefully planned site design that improves the quality of life of residents was regarded as a critical success factor for a HCC, as approved by the participants. They also highlighted several social benefits, citing them as an important focus area. This in turn directly impacted the sustainability agenda of HCCs and their targeted projects. The social benefits of SBMs, according to the participants are; better quality of life outcomes, high customisation, customer satisfaction, opening new job opportunities, enhance social interaction, increase safety, increase public participation, support research and innovation and universal accessibility besides enabling an ethical business. In general, participants found their HCCs unable to understand customer needs or design value offerings that fully met customer requirements. According to Jonsson & Stiller (2016), to incorporate sustainability in a project, merging the social and economic dimensions was troublesome. This section reports on the participants' observations on social benefits from introduction of a SBM to the end users. It also refers back to the fundamental concept of community formation, which needs rethinking in order to become socially sustainable.

The social aspect at its core places the wide range of social needs that should be considered for successfully implementing social sustainability in existing or new SBMs. Participants believed that SBMs could place a HCC in a position that positively alters the quality of life of its residents. CO3 describes the model as a, *"socially healthier proposition with bigger returns concerned mostly with the health of the community and maintaining the quality of life of the residents."* In a similar vein, MH2 stressed the idea of increasing the safety of residents and TCs by raising the quality of the SVP, *"I think raising the quality of housing products is one of the most important benefits of the sustainable model. That high quality will impact positively on the family and its safety*." UN2 had a concurrent view of designing and planning a safe and healthy product while providing the basic services to meet community requirements, secured land tenure and promotion of social responsibility.

Evidence from literature shows that rapid urbanisation as a result of Saudi Arabia's strong economic position has led to huge investments in infrastructure development. However, housing projects in several locations, most of them in close proximity to a developing city, became unattractive due to their non-personal appearance. In this regard, participants thought that by addressing the basic needs of customers, such as quality housing, jobs, education, religious participation and community building in general, they could improve the quality of life of residents. RD3 strongly believes that SBMs adoption could contribute to the company's performance, with as he explained, *"improvement in terms of provision of facilities, such as sports clubs, walking lanes and social activities. This infrastructure could provide more acceptability and enhanced walking and bicycling options for residents."* Therefore, customers want a complete solution in which they can benefit from an environment-friendly construction with social facilities while paying a low price for acquisition. According to UN1, *"improvement in quality of life for the residents and achieving sustainable development goals is necessary for business success."* Participants reported dealing with social aspects of the SBMs as the most challenging because there were no clear guidelines in this area, unlike environmental sustainability, where HCCs aimed to balance construction and operational efficiency with costs paid by consumer and meeting environmental certification standards.

Delivery of high quality products without compromising on essential features such as safety, comfort and convenience is one of the benefits a customer would receive from a SBM. In this regard, MH2 said, *"raising the quality of the housing products is one of the most important benefits where the high quality will impact positively on the family and its safety."*

Therefore, HCCs needed to rethink the basics of value delivery and capturing methods as high quality meant high price, which the customer was unwilling to pay upfront. Similarly, HCCs proposing social benefits embedded in their value proposition had to earn their reputation as a business leader in the market. Putting it simply, RD1 stated that, *"prove its reputation as a credible and ethical business and prove that it is proactive in serving the environment and society."* Therefore, SBMs let HCCs send out a clear message to consumers allowing them to search for their products and services with ease. Developing a strong reputation in the HCI market is critical for a HCC's success, since customers want to see working examples of the three dimensions of sustainable development. In essence, a HCC should develop KAs and support from PNs in a way that allows it to replicate projects in different market conditions to earn a reputation as a sustainable business.

According to some of the professionals, the ability to customise a product with a high level of flexibility was a desired feature among many consumer groups. HCCs capable of delivering SVPs and housing units that matched consumers' personal choices and allowed them to further modify the internal and external environment of their dwellings created a sense of pleasure and satisfaction. CO1 explained that, *"the advantage of having a flexible design is in the ability to offer various solutions for most target customer segments and not having only one or two designs from which to choose."* Thus, firms could offer a base pricing mechanism where the customer paid for the building structure and every additional feature would be customisable, adding to the final price paid by the consumer. This meant every customer would pay a different price, according to the level of customisation and flexibility offered by the HCC during the design and construction phase. However, such pricing mechanisms demand that a HCC has significant experience in working with ICT technologies, and software that allows high customisation levels.

As matching the needs of the customer has been linked closely to satisfaction levels in earlier studies (A Pekuri et al., 2013), RD2 said that, *"the sustainable value must match the needs of the customer and if not, we will see what we called supply doesn't match demand."* In general, practitioners were concerned about the failure of large-scale government and privately-funded projects that earned them a bad reputation. Prime factors for this phenomenon, as seen in a study by Jonsson & Stiller (2016), were segregation, high level of unemployment and a high degree of low-income households needing financial support. As RD2 pointed out, *"In the market today, if you do a small survey, you will clearly see plenty of empty housing on the market."* The possible reason for this, as RD2 argued, is that, *"there are ads for apartments, villas and housing units at competitive prices, but they do not meet the needs of the community so no-one buys them."*

Participants unanimously agreed that HCCs seeking SBMs had to create new job opportunities. The SBMs, according to RD1, in a major way, *"cared about the society and, as such, a model is offering a new SVP that will provide new job opportunities."* These opportunities in which a HCC extends benefits, such as a service delivery model, are opening up new revenue streams, increased customer satisfaction levels and developing a cohesive environment where customers are ingrained in the society, thus having less chance to leave the community. Therefore, selling a SVP is not deemed sufficient with regard to achieving social sustainability BMs. It is equally important for HCCs to plan SBMs and products that enable residents to become aware of their surroundings and participate in improving the quality of lives of its members.

Social integration, according to CO1, is the culmination of efforts included in the HCC's SBM to create a social environment that provides many open spaces for social activities and cohesion between families and other residents. Another social sustainability factor considered by the participants was to engage and increase public participation activities. This was achieved through creation of new jobs and services. Project designs that dig deeper into investigating consumer concerns about existing BMs and translate them into prototypes that demonstrate firms' capacity to solve these problems promote HCC' entrepreneurial skills and improve their technological capabilities. Provided that HCC could take care of meeting the needs of all consumer types, especially the elderly, children and people with disabilities in the design phase, it could alleviate many other incremental problems that would arise when the construction was finished. CO3 explained that, *"if a residential complex means (SVP) was provided, it should have a check list of the required items at the community level, for example, universal access for people with special needs and the disabled. This would help the universal access ranking in the country."* Social sustainability, in essence, is careful consideration of even the smallest consumer needs. It is the small things that make a difference, according to the participants discussing how firms could earn a reputation for being socially responsible.

In summary, the intangible benefits of SBMs aim to improve the comfort and quality of life in general, which can create the distinction between HCCs that talk about sustainability and those that deliver actual SVPs and solutions in their HCI through SBM adoption. HCCs should learn how to balance the three sustainability dimensions by creating sustainable value propositions that respect cost, environment and customer needs, in equal proportion.

5.1	**5.2**	**5.3**	**5.4**	**5.5**
Introduction	Research Context	Method of analysis	Interview Findings and Discussions	Summary

5.5 Summary

This chapter has presented the empirical findings of interviews with stakeholders working in the Saudi HCI using semi-structured interviews with twenty-two practitioners, professionals and government leaders comprised of managers, academicians and full-time members of HCCs. The chapter started with a description of the Saudi HCI and a brief insight of the participants and their work profiles and contributions to the industry. This was followed by a thematic analysis of interviews. The aim of this chapter is to generate a full picture of what concludes and defines a SBM in the HCI and the elements needed for its development to segregate observations of participants into changes, challenges and benefits rising from the transformations. The changes needed to achieve SBMs are categorised into six distinct areas needing further examination. The challenges that firms face in promoting SBMs for the HCI are investigated according to the PESTEL framework. Lastly, the benefits arising from SBM adoption is discussed in the light of participants' responses.

The findings that emerge from this chapter are summarised below:

- Definition and acceptance of the term's 'sustainability', 'sustainable development' and SBM: This is to help create a more unified vision of the objectives that sustainable businesses hope to achieve in the HCI. Setting the baseline of objectives to be met under sustainable development would bring about radical transformation in the industry. In this regard, a definition of SBM was provided, which can be a starting point for industry observers.

- The use of nine elements defining the business sustainability parameters according to literature emerged. These are SVP, TC, DC, CR, VC, KR, PN, CS and RM. The participants' insights are used to create a picture of what a SBM would look like. The results reveal that participants knew about the changes needed to establish a SBM and the benefits arising from this transformation. However, they were yet to see tangible changes in their sectors that promoted 3BL as the goal rather than considering financial profitability as the only business driver.

- Changes: The six areas of change are not exhaustive but serve as a starting point for scholars aiming to develop a robust framework for these changes to be applied in the mainstream. Changes that have occurred or are yet to occur in political, media, consumer and self-awareness paradigms are discussed. This approach will provide guidance on SBM transformation so that HCCs and concerned individuals can make informed decisions according to their requirements.

- Challenges: Keeping the industry trends in consideration, participants suggested six major challenges in the way of SBMs growth and uptake. These are, in decreasing order of relevance, social, legal, technological, political, economic and environmental challenges. It is vital that these challenges are overcome for SBMs to thrive in Saudi HCI.

- Benefits: From the findings, it is possible to gauge the benefits of adopting SBMs in the HCI. These benefits are divided into social, economic and environmental benefits. It is necessary for firms to treat each area as equally important.

In order to achieve the research aim, it is necessary to develop the model to help top management and developers within the Saudi HCI to implement the SBM concept. The next chapter outlines use of the Interpretive Structural Modelling technique (ISM) as an effective tool in preparing the hierarchical structure of the SBM elements for the implementation phase.

CHAPTER 6

Development of the SBM Framework, Discussion and Validation

Sections

6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8
Introduction	Focus Group Profile	ISM Modelling SBM Implementation Framework	ISM for SBM Challenges	Practical Guidelines for Managers	Validation	Recommendations	Summary

Chapter 6. Development of the SBM Framework, Findings, Discussion and Validation

6.1 Introduction

This chapter provides information on the interaction, relationships and hierarchy among different SBM elements and the challenges associated with the implementation using the interpretive structural modelling (ISM). The previous chapter presented the SBM elements, changes needed to adopt SBM, benefits from SBM use in HCCs and challenges to its application. Analysis of data found all SBM elements had varying levels of influence or dependence on other elements. The same nature of influence was discovered for challenges reported during data collection. Therefore, adaptation of the ISM model to recognise interactivity between elements and challenges is the focus of this chapter. In this chapter, relationships between SBM elements and the way the challenges influence each other is performed to rank SBM elements with reference to their utility to the model. For example, the most influential element is placed lower in the model. To achieve this task, the chapter uses the Interpretive Structural Modelling (ISM) based approach and the Structural Self-Interaction Matrix (SSIM) ranking method. The ISM technique creates a hierarchical structure according to the input of the participants and their views on the elements and its positioning in respect to other elements of the model. On the other hand, SSIM and its set of tasks, such as developing a Reachability Matrix (RM), MICMAC Analysis and calculating the driving and dependence power for each element, provides an ordered list of elements in terms of their dominance and relationship to other SBM elements.

Following the introduction, this chapter has six parts. The first part develops the implementation model for the ISM by identification of SBM elements from the previous chapter, creating an SSIM and presenting the evidence for the relationships using the focus group method. The SSIM is used to develop the RM and MICMAC analysis, which is then used to calculate level interactions for each element. The final model is, thus, developed in the second part of this chapter. The second part provides a discussion of the modelling technique and reviews the processes used in this chapter. The third section contains the ISM model for SBMs challenges, and the same procedure is applied to establish the nature of relationships between SBMs challenges to create dependent relationships and driving forces among the challenges. The use of focus groups allows strong connections to be identified between the challenges. The fourth section contains a discussion on the ISM-based generation of the model that interlinks all the challenges associated with implementation of the SBMs framework. The fifth section describes the process of validation and how these findings are reviewed by focus group participants to extend the validity of the technique and the study in general. The chapter concludes with a summary of the processes and notable findings that emerge from discussion with focus group members.

6.2 Focus Group Participants Profile

The core principle of using and employing the ISM method is to highlight the perceptions of involved participants. Here, a group sample of five experts having vast experience in the HCI regarding SHPs at different levels of capability is taken. More about the criteria of choosing the members involved in this phase of research has been discussed in section (4.8.2). Table (6-2) below provides details about the participants in the focus group.

Table 6-1: Focus-group participant profile

No	ID	Position	Type of organisation	Experience
1	FG1	Real Estate Development Director, Saudi investment group and marketing company	Real Estate Development Organisation	28
2	FG2	CEO	Real Estate Company	35
3	FG3	Associate Development Director	International Consultants	36
4	FG4	Sustainable Infrastructure Advocacy Leader	Building and Infrastructure Company	14
5	FG5	Vice Chairman	House-Building Company	13

The group participating in this research functions as the ‘Experts panel’ in which they help to investigate and gain an understanding of the complex relationships outlined among the identified elements in the SBM and a similar approach for the implementation challenges. The members who constitute the expert panel include two professionals from the real-estate sector working as developers, two housing construction organisations with significant experience in the industry, and one consultant with expert knowledge in sustainable practices.

6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8
Introduction	Focus Group Profile	ISM Modelling SBM Implementation Framework	ISM for SBM Challenges	Practical Guidelines for Managers	Validation	Recommendations	Summary

6.3 Development of the SBMs Implementation Framework using ISM

Developing a systematic method for implementation of the SBMs framework in the context of Saudi Arabia’s HCI while following ISM methodology requires examination of chapter 5, which presented the SBM elements and its sub-elements drawn from an understanding of the literature and analysis of interviews that led to notable findings. The outcomes of the interviews indicate the existence of direct and indirect relationships between elements in the SBM framework. The exact nature of these relationships was not clear from the response of participants in the interviews. The elements are the building blocks of the model. It was important to remove ambiguity from the relationships between the elements to complete development of the SBM framework as a function of organisational structure and strategy. The relationships were crucial in describing the SBM to visualise its industrial transformation capacity. Therefore, viewing the framework as an interrelated object instead of focussing on a single element in isolation was necessary. The study used a focus group method to develop this understanding and design the final SBM diagram, which shows dependencies between two or more elements in the SBM. ISM lends its design capabilities and helps to develop a collective understanding of relationships that are drawn from the insights of the real estate and housing development market. The focus group comprises experts within this industry. Their responses on issues relating to SBM challenges in the HCI are the most valuable experiences, which could guide the modelling of key elements of the

SBM using structural modelling techniques. The next step is the identification of the elements needed for the framework development.

6.3.1 Identification of SBM Elements

The ISM model design starts with identification of the elements of the SBM framework. In this study, nine elements have been identified in the context of SHCI. These are already discussed in previous chapters. The elements and descriptions are given in the following table:

Table 6-2: The SBM elements and description

SBM Elements	Description
Sustainable Value Proposition	Provides high-level knowledge of all products and services that could be of value to a user.
Target Customers	A group of people for whom the firm would like to deliver value.
Distribution Channel	A chain of businesses or intermediaries through which goods or services pass to reach the end consumer.
Customer Relationships	Established links between businessess and customers.
Value Configuration/Key Activities	The way activities are arranged, and the resources required to create value for customers.
Capability/Key Resources	The quality of repetitive execution of actions necessary for value generation for customers.
Partner Network	An agreement with two or more companies (external) for creating customer value.
Cost Structure	The representation of capital in all the means used in the BM.
Revenue Model	Shows how the business makes earnings with a variety of revenue flows.

6.3.2 Structural Self-Interaction Matrix (SSIM)

The nine elements that comprise the structure of the model and the contextual relationships between them are presented in this section. The relationships between elements can be relative to each other, influential, comparison-based or sequential (Austin & Burns, 1985; Warfield, 1974). The SSIM generation is an important and challenging task within the ISM category. The structural analysis helps to reduce and filter information originating from group-level thinking to a small number of experts in the field; it is a refinement of overall knowledge of subjects analysed into a ‘single set of data’. As Warfield (1974) suggests, the ideal number for this activity can range from five to 10 participants.

During group discussions, the expert group is required to decide on pairwise relationships (for example ‘X’ leads to ‘Y’ type) between the nine elements of the SBM using an approach similar to that used in the PESTEL challenges. This activity would indicate the impact of one element on another, and the nature and extent of this impact would be revealed during discussions. Based on associations identified by the Expert Panel, elements and their relationships, as well as the direction of those relationships, if available, were considered and the SSIM was then developed. This phase required extensive consultations to develop the constructs that formed the relationships among the 9 elements of the SBM. Participants were asked whether they saw a pairwise relationship between the rows (i) and columns (j) by denoting the direction of the relationship and using the following symbols:

- **V:** if a direct relationship exists but only in the direction from i to j
- **A:** if a direct relationship exists but only in the direction from j to i
- **X:** if a direct relationship exists between i and j in both directions
- **O:** if no direct relationship exists between i and j

On the foundation of the pair-wise relationship between the elements in the system, a structural self-interaction matrix (SSIM) was developed for the elements. The SSIM was discussed with the focus group experts. Based on their answers and discussions, the SSIM was, as shown in table (6-3) below.

Table 6-3: Structural Self-Interaction Matrix (SSIM)

NO	SBM Elements	1	2	3	4	5	6	7	8	9
1	Sustainable Value Proposition (SVP)	X	X	X	X	V	V	V	V	V
2	Target Customer (TC)		X	X	X	V	V	V	V	V
3	Distribution Channels (DC)			X	X	A	A	A	A	A
4	Customer Relationships (CR)				X	A	A	A	A	A
5	Value Configuration/Key Activities - (VC)					X	X	V	A	V
6	Core Capability/Key Resources (KR)						X	V	A	V
7	Partner Networks (PN)							X	A	V
8	Cost Structure (CS)								X	V
9	Revenue Model (RM)									X

Based on the information from the above matrix, it is evident that there are relationships among the SBM elements. It is visible that the SSIM leads to addition of linkages among elements, strengthening its utility as a well-functioning system. The relationships between the elements of the SBM are drawn from the focus groups, which bring credibility to the outcomes of the results chapter. The existence of relationships between two or more elements and the direction of each element in relation to another element is questioned. In total, 36 relationships were identified and each of these relationships is examined according to their respective cell numbers. As an example, the relationship between SVP and TC is given in cell 1-2, whereas the relationship between SVP and VC is presented in cell 1-5.

1. Cell 1-2: The relationship between the SVP and TC (X): After analysing TC and SVP individually and cumulatively, the participants indicated that TC and SVP have a two-way direction relationship with each other. The participants spoke in agreement on this two-way relationship during discussions. As FG2 said, *"The relationship between SVP and TC is mutually exclusive. It means there is a direct effect of SVP on TC and TC on SVP. In the past, firms have come to the customer with amazing VPs, but the TC rejected them as they did not match their needs. So, we see the trick is to focus on TC and then generate the SVP for the TC, which also aligns with the overall business goals.'* In another example, FG5 said, *'there is a shared relationship because the customer lies at the core of the SVP. All collaborative and participatory activities originate through the ideas laid out in the SVP. Thus, the SVP improves and perfects itself with increased collaboration*

and also drives customer satisfaction and loyalty." According to FG1, "*The starting point for the SVP is radical because it focusses on the needs of the customer. While trying to target sustainability, the focus should be on the triple bottom line to launch a successful community development. This is the value that must be seek. The SVP and TC are the keys to your business's competitive advantage. The rest of the elements fall in line when the SVP and TC are aligned correctly."* Based on input from participants in the focus group, it is understood that the SVP and TC are mutually dependent elements. As these elements drive each other, their relationship must be denoted with (X) in the matrix under cell 1-2.

2. Cell 1-3: Relationship between the SVP and DC is (X): Based on the results generated during the discussion, a positive and two-way directional relationship is established between the SVP and DC. For example, aligning the SVP with the TC requires selection of consumer-friendly sales channels. Therefore, the TC is found to have an impact on the SVP, which has an impact on DC. To drive management selection strategy towards the correct DC, a thorough understanding of the SVPs is imperative. As FG3 mentioned, *"presenting customers with the visual model of green development goes hand-in-hand with the SVP. Unless customers can see the initial model and draw creative visualisations of the benefits of the SVP, the model will not be accepted by customers. So, firms have to work hard to decide which channels of distribution to choose to reach and convince customers."* In another example, FG5 said, *"despite having examples of SVPs in the market, they have yet to reach the right customers. Even if they reach the right type of customer segment, the TCs are unable to relate to the suggested benefits. Here, technology can serve as an indispensable tool to help towards this recreational process. I would like to see the marketing teams taking the lead in using their networks to present sustainable development-based solutions in a customer-friendly package."* The response invariably positions DC as a direct beneficiary of activities implemented in the SVP as part of the TC. The response from the focus group indicated a direct relationship between the SVP and DC, due to which it was marked as (X) on the SSIM table.
3. Cell 1-4: Relationship between the SVP and CR (X): The type of relationship was a two-way direction and shows the importance of understanding the type of customer relationship that should be developed by the firms for each TC. In the words of FG1, *"customer feedback is a critical process that shows how well value propositions are*

fulfilled by the model." In firms of modern-day construction, understanding the type of relationship needed to develop with a particular TC is a trivial problem. Understanding customer needs periodically and taking regular feedback of services delivered are two areas that can build a strong CR with almost every TC. As FG4 said, *"there is a growing demand to collect greater feedback in the process of SVP design. This would allow a healthy co-creation of value and benefit all the participants. Customers generate comments that allow us (HCCs) to understand their needs better and develop a better product."* Firms should develop the right environment for customers to share their feedback and continue this cycle until the value delivery and value capture stages. According to FG5, *"Taking customer feedback is critical for business success, especially in housing construction where the customer is from a diverse background. Customers value products and companies that take their feedback seriously."* Knowing the type of relationship – personal, digital, automated or personalised – a HCC should develop with its TC – for example big business, wealthy consumer, average and small-scale consumer – is the way HCC could get, keep and grow the customer base. Comments by the focus group participants suggest the importance of knowing the appropriate CR for each SVP as an indispensable part of the SBM. Therefore, the SVP and CR relationship is denoted as (X) in the matrix above.

4. Cell 1-5: Relationship between the SVP and VC (V): The response from the focus group on the type of relationship between the SVP and VC was unidirectional. This is because the SVP drives changes in the activities undertaken by a HCC as part of its product development and delivery process. Changes in the SVP, driven by TC needs, drive all the major activities during the product lifecycle to meet sustainability objectives. In this regard, FG2 said that, *"having the right type of VC aligned and ready to use to serve the needs of customers requires a clear vision by the firm on the type of products and services it offers. While promising a sustainable product, it is very likely that the underlying manufacturing processes and materials used will be different, which the customers may not be able to understand at first or may doubt its performance and reliability. Therefore, such doubts need to be removed from the start in the minds of consumers so that the sustainable product can be marketed effectively."* Another comment made on VCs driven by SVP was by FG5, "... *VCs are the primary level changes needed in the SBM to fulfil*

its SVP. These are the most fundamental things we need to do to develop a site and turn it into a SVP." Therefore, based on comments made by the members in the focus group, it is deduced that VCs are created, changed, modified and replaced by firms to fulfil their SVPs. Knowing which VCs to change and modify according to a given SVP is a crucial business success factor, which is later realised in terms of cost savings. Since the SVP has one direct impact and a top-down relationship with VCs of the firm and its partners, it is denoted as (V) in cell 1-5.

5. Cell 1-6: Relationship between the SVP and KR (V): The participants in the focus group shared the importance of key things needed by their firms to fulfil the VPs they made, or partially developed, with each of their TCs. Therefore, they needed to acquire unidirectional linkage between the SVP and KR, with the SVP driving the firms KRs. As FG4 said, *"when we propose a SVP and promise its development, we need to take the social, environmental and economic implications into consideration in the value creation phase. Ensuring that we fulfil all the parameters of sustainable design and development and provide a product that meets the expectations of customers, as set out in the beginning through the SVP, is critical for project delivery. We cannot go back to the consumer with missed deadlines, faulty processes, and an unsustainable project. The selection of design, production and operational phases of the sustainable solution drives the benefits promised in the SVP."* Therefore, KRs are the sets of resources that firms acquire to create the promised value. The key resources that HCCs need; for example, a team of experts, factories, brand, intellectual property, technological capital, among others, to deliver the value that was promised to the customer in the SVP, drive changes in KR, and is denoted as (V) in cell 1-6.
6. Cell 1-7: Relationship between the SVP and PN (V): In this dimension, the relationship exerted by the SVP on PN is one-way and moderately dependent. The participants in the focus group expressed the view that in the event of creating and fulfilling a SVP, if the HCC suffers a financial setback that affects the product creation and delivery processes, it can accept help from the available networks; for example, government, non-profit organisations, construction companies, technology solution providers and private lenders, to meet its primary business objectives. However, FG2 added that, *"our partners help us in times of need, but we are not dependent on them for the procurement calculation."*

Consequently, the SVP has a control of the selection of PNs and its effective utilisation according to the requirements of the SVP, but it is not always a requirement for a parent firm to seek partners for fulfilling value propositions. PNs are useful in some instances to build fast, scalable and meaningful relationships on which businesses can grow and develop their entire BM. However, this is not entirely the case as sometimes HCCs need limited PNs involvement to meet their business needs and ensure sustainability for the model. However, in both cases, the SVPs, with which firms reach out to their customers, have a direct and visible impact on the nature and type of relationship extended to PNs to achieve sustainability goals. In conclusion, discussions with the focus group indicate that partners and the entire support network are affected by the type of VP and the firm's capability in delivering this value to the customer.

7. Cell 1-8: Relationship between the SVP and CS (V): Based on the discussion, SVPs have a unidirectional relationship with the cost incurred during the project lifecycle. The cost structure describes the most important costs during all phases of the SVP development and can vary from one SVP to another. Knowing the cost structure requires understanding of the kind of SVP that drives later elements, such as VC, KR and PNs through its own set of relationships. These elements and knowledge about the costs of arranging them to fulfil the SVP develop the CS, which the firm can use to make decisions. According to FG2, *"a single VP can be achieved in various ways. For example, I can give customers 2-3 options for materials, each of which will have an impact on price and costs."* Therefore, TCs' needs and abilities to pay can vary and are reflected in the SVP, which, in turn, affects decisions made by the developing company in terms of material selection. FG5 stated that, *"It is important that consumer needs drive cost structure instead of firms pushing available technologies as solutions to customer needs."* Cost structures, therefore, rely on customer demand in terms of SVP solutions and the firm's ability to deliver and have knowledge of the costs involved. The relationship between the SVP and CS is marked as (V) in cell 1-8.
8. Cell 1-9: Relationship between SVP and RM (V): The views expressed in the focus group discussion indicate a unidirectional effect of the SVP on RM. This is because the underlying VCs, KRs and PNs dictate the terms of selection of appropriate channels, which, in turn, drive cost estimation and finally the business's revenue model for that

product. According to FG3, *“to create and deliver SVPs, firms must understand and map their business activities and convert them into cost structures which are later used to make sense for estimation of revenue generation activity.”* However, it is possible to capture revenue only when firms know what value customers are willing to pay, which the firms include in the SVP. As FG5 mentioned that, *“production of sustainable revenue requires a customer-centric approach and consideration of the value customers are willing to spend to alleviate their needs in the housing market. Thus, the product will be priced according to its estimated worth in the market.”* In another statement, FG2 said, *“creating an environment that changes the mindset of customers upfront and encourages them to respect and adopt sustainable values, not just for themselves but for the environment, community and the planet, will help in green product development, which can be priced profitably and competitively alongside non-green products.”* The idea here is to develop the market sense and invest in changing the views of consumers so that they can appreciate the value of sustainable products. Change in customers’ views combined with fulfilment of their needs and concerns and the multiple benefits that sustainable housing provides will attract investment in this sector and drive the RM. However, RM cannot dictate how value propositions should be defined or practised in the sustainable market. Therefore, the SVP and RM have a unidirectional relationship, as denoted in cell 1-8.

9. Cell 2-3: Relationship between TC and DC (X): Some of the misconceptions in the type of relationship that TC extends to DC were cleared during focus group interactions, similar to those depicted in the qualitive chapter. Customers preferred interactions through channels they were comfortable with. Likewise, firms wanted to use their existing DCs to deliver products and services. Therefore, selection of appropriate channels is dependent on parameters that facilitate interaction, communication and delivery of SVP without having a significant impact on TCs. In general, participants in the group agreed on a direct relationship between the DC and TC element while stressing that every TC is different and would require HCCs to have a unique strategy and DC to reach such customers. Selection of the right DC depends on the interests of the consumer and the channels they prefer. For example, using DCs, such as roadshow events and conferences on sustainability, can have a positive impact on consumers, but are able to capture only a

small segment of consumers. Thus, distribution channels need to evolve and change, based on TCs. For example, FG3 said that *"a smart house interface online with proper planning tools would offer an interesting solution for the consumer, eventually changing or influencing how they plan for their homes or seek benefits that HCCs can offer at competitive rates."* The comment suggests that DC needs to support TC interactions throughout the project lifecycle, from the ideation phase to execution. Likewise, the TCs should find and use DCs that will help them achieve the best solutions, according to their needs, in the SVP. Keeping this in mind, TC and DC are marked with an (X) relationship, as shown in the matrix in cell 2-3.

10. Cell 2-4: Relationship between TC and CR (X): Some of the participants indicated a two-way relationship between TC and CR; for example, use of meetings and feedback from customers regarding house planning and design, higher the acceptance and satisfaction of the TC. According to FG4, *"CR has a measurable impact, which can be seen through better communication with TC. Such interactions create rich data which, on analysis, can help firms create better SVPs. Selecting the right CR for a particular TC can lead to better targeting, and customer support offered to a particular customer segment."* In contrast, lack of involvement of TC in available CR meetings would indicate capture of new markets. Therefore, the nature of the relationship between TC and CR originates from TC in the case of well-developed and developing markets, but CR is a helpful approach for reaching out to new customers and creating SVPs for those segments. Therefore, it is valid to state that CR and TC have a bi-directional relationship, denoted as (X) in cell 2-4.
11. Cell 2-5: Relationship between TC and VC (V): As found in the focus group interactions, TCs play a major role in shaping SVPs, based on which VCs of HCCs are aligned. Therefore, changes in the VCs and any processes thereof require customers' assistance through participation and meeting requirements. Discussion related to the impact of the TC on VC invoked mixed reactions, but the members concurred on a direct and significant relationship originating from the TC and shaping processes aligned under VCs. For example, FG2 stated that, *"projects with high-level flexibility and easy design modifications by consumers report significantly higher satisfaction scores than projects listed as build-and-sell models. As such, customers can help design developers make*

modifications in the number of bedrooms, overall house design, blueprint level modifications, arrangement of living spaces, selection and choice of materials for flooring and walls." These are often neglected in projects that fail to establish strong customer relationships in which the consumer feels comfortable sharing requirements from the starting phase. Likewise, in some projects, such channels are opened late in the project delivery stage, leaving limited options for modification by the developer or recommendations by the consumer group. As FG3 mentioned that, *"Customers' contributions are very helpful to the process of housing design and development as they are the end-user and they will respect and seek a healthy relationship if their initial needs are met, which is necessary for the firm to sustain its revenue streams."* Engagement and maintaining relationships with suppliers are crucial for the firm. When TCs drive VCs provided by a firm this helps to collect data on the trends and patterns of consumer choices in terms of the SVP. As TCs are the major segment of people paying for the value, it is important that they drive the activities of the firm. The points mentioned above indicate a one-way directional relationship extended by the TC and driving VC, which is denoted in cell 2-5.

12. Cell 2-6: Relationship between TC and KR (V): According to the response from the focus group on linkages between TC and KR, it is evident that customer demand and the needs of the SVP will drive alignment and changes in KRs. According to FG5, *"when customers are seeking cost savings in energy and water for which they are willing to pay more upfront to develop long-term benefits, it automatically changes the capability infrastructure model."* Likewise, the SVPs needed by the TCs will form the firms' KRs. It is also the fundamental service delivery structure. Therefore, participants have unanimously agreed that the TC has a direct and impact-driven relationship with the KRs that a firm provides to achieve the SVP. According to the response and views of participants, cell 2-6 was marked (V), indicating a one-way relationship between TCs and KRs.
13. Cell 2-7: Relationship between the TC and PN (V): The response on the existing relationship between the TC and PN is analogous with the VC and KR due to the nature of these elements. Consumers are often regarded as partners due to their role as enablers of value. The TC can sometimes share the same responsibilities as PNs by engaging in

bringing new customer segments or serving as channels to reach another TC. Some of the participants in the focus group were of the view that PN, DC and TC have a similar meaning in the SBM, while others preferred keeping the TC as a separate element due to its role in SVP development. As an example shared by FG1, *"a TC could be a public or private organisation for which a firm develops a housing or corporate project, and the same TC helps by reaching out to a new segment of consumer for which it works as a partner to help create, deliver and capture value, as promised in the SVP for the newly-acquired TC."* In this model, the new customer group pays for the product whereas the primary customer segment helps in generating mutual benefits for the end customers along with the primary HCC. Therefore, PNs, while being TCs in the first instance, eventually turn into PNs while sharing a significant portion of the financial risk. The nature of the relationship between the TC and PN is often blurry but, nevertheless, originates from the TC and turns into a PN, which can lead to its categorisation as (V) in the SSIM, as denoted in cell 2-7.

14. Cell 2-8: Relationship between TC and CS: The response from the focus groups indicated a one-way directional relationship driving the SVP and CS. It was found that TCs, which have a vital role in SVP creation, eventually have a direct impact on the CS. Apart from the preliminary cost structure estimation methods that a firm uses to calculate development costs (LCCA), it is necessary to predict the prices customers are willing to pay for the product and the main factors that lead to the estimation of that value. While calculating costs, the TC invariably plays an important role in defining what the final cost structure would look like for the HCC when seeking sustainable sales. As FG5 said, *"the difference between sustainable and non-sustainable BMs is the degree to which the company studies consumer need and capacity for paying for that product. When the developers make the cost drive the consumer, the consumer will endure long-term repayment."* While the nature and extent of this impact could vary, it is assumed that CS is driven by requirements as laid out by TCs in a unidirectional relationship, which is denoted as (V) in cell 2-8.
15. Cell 2-9: Relationship between TC and RM (V): There is a one-way directional relationship between TC and RM of the HCCs, based on input from the focus group. Considering an example given by FG2 where he said, *"Each TC will come to a HCC*

with a set of requirements. Some will seek long-term solutions while others may seek a quick resolution to the problems they are facing. The HCCs should understand their problems and provide them with sustainable answers while realising revenue in the process. Since each problem is unique, revenues realised from such solutions cannot be the same." In another note, FG4 highlighted an idea saying, *"SVPs begin by asking consumers about their needs and estimating the prices they are willing to pay to obtain solutions."* In both events, HCC will notice that revenues are generated but not in a similar way in each project. Therefore, the focus group viewed the TC as having a direct impact on the RM, but it was the HCC's responsibility to capture the revenue creation logic and the opportunities associated with it in the most appropriate way. According to FG5, *"It is quite easy to see that the customer who is paying for the value will show as direct revenue. However, it is important to see the hidden opportunities of revenue creation and tap into those processes during the project lifecycle. This would make the nature, extent and flow of revenues and the understanding of the RM unique in every TC."* In conclusion, TCs have a major role in defining RMs, which a HCC realises in the course of the process. Therefore, based on the above statements, the TC has a one-way directional and a unidirectional relationship with RM, as denoted as (V) in cell 2-9.

16. Cell 3-4: Relationship between DC and CR (X): The discussion on this relationship suggested a mutually beneficial relationship among the two elements in the SBM. This is evident, as both elements have value offerings for each other. For example, customers with a high degree of knowledge about the benefits of the SBM and the produced SVP may want to develop a very close relationship with the HCC using its direct DCs. In such a case, HCCs should be capable of providing personal assistance to such customers. However, in large scale consumer housing, HCCs could use personalised services through automation technologies to guide consumer choices and behaviour. As FG1 said, *"developing the right channels of relationship with customers drives down the cost of DCs, as one segment of consumer can provide a new customer segment through the same DC, therefore reducing overheads. Also, customer satisfaction is a game-changer in the new markets as the word can spread quickly and, at a time of high technological integration, a product can be sold out very quickly."* Therefore, CR has a direct and dependent relationship on DCs, which plays a vital role in customer acquisition,

satisfaction and retention. Reducing the cost of the DC can be achieved by improvements in CR and a balanced marketing strategy. As FG3 noted, DC and CR must fit together like a puzzle and complement each other to produce a positive overall result. Thus, it is deduced that DC and CR have interlinking, which at best is represented as a (X) in cell 3-4.

17. Cell 3-5: Relationship between DC and VC (A): The response of participants in the focus group indicated VCs as the influencing agent on DC's selection and use. As FG3 commented, *"One of the key activities of the firm is to train and educate distributors of the value offering that they can provide to the TCs for best customer experience."* Therefore, VCs contain provisions for firms to target DCs that they engage within the process and develop their potential so that they can reach out to customers effectively. To create value for the TC and the firm, DCs need to have carefully placed communication channels that provide timely interaction between value creators and those who receive value. Thus, sales channels with good knowledge of the produced SVP and its benefits for consumers are necessary. DCs must have the capability to educate customers using all possible mechanisms and make them a part of the value creation process. This would help firms to create SVPs that are attractive and appeal to the consumers. Although it may take some time for firms to respond to consumers with personalised solutions, it would have a profound impact on the activities and processes conducted later in the project lifecycle. From the views expressed by focus group members, a one-way relationship between VCs and DCs is deduced. This is reported as a (A) in cell 3-5.
18. Cell 3-6: Relationship between the DC and KR (A): In view of the responses generated during interactions with the focus group, KR exerted direct influence over DC. For example, FG1 said, *"sustainability experts bring valuable networking connections that allow us (firms) to reach out to customers (government) with SVPs."* This statement suggests that the sustainability environment is growing and has a reducing impasse in the HCI, as seen in the last thirty years. The team of experts in sustainability serves as a KRs in a partnership with which HCCs can engage, providing technological expertise and connecting scattered organisations to connect with sustainability-driven HCCs. Situations in which KRs can be applied strategically should be valued as they help

improve interactions between DCs and customers. FG4 mentioned that, *"creation of certain capabilities and value generation requires value configuration in ways that are modernistic but that also keep in mind that some configurations in DCs can allow the opening of new revenue models."* According to the inputs of focus group members, it is possible to state the impact of KR on DC and its role as a driving mechanism in activities undertaken by DCs in reaching out to customers. The dependence of DC on KR is shown as (A) in cell 3-6.

19. Cell 3-7: Relationship between the DC and PN (A): The focus group highlighted the influential nature of PNs on DCs during the discussions. As such, selection of PNs can significantly improve the capabilities of DCs and provide HCCs with a range of options to reach new TCs in mutually beneficial relationships. When PNs include TCs as an element in designing and shaping SVPs while also emerging as an entity that connects new TCs to HCCs, it is possible that PNs have an impact on DCs. According to FG3, *"HCCs can select PNs that solely take over the DC element of the firm and try to deliver value through the use of new technologies and innovations in the BM of the partner itself."* Thus, VC and KR can involve the use of PNs that allow HCCs to deliver cutting-edge solutions to communication requirements, bringing customers closer to the company responsible for delivering sustainable value. In this one way, relationship, the goal of the customer and the partners, is met with improvements in the communication and distribution value chain. From the findings of the linkages between DC and PNs, it can be safely assumed that PNs drive DCs in the firm, as denoted as (A) in cell 3-7.
20. Cell 3-8: Relationship between the DC and CS (A): The participants in the focus group agreed about the influential nature of CS in driving selection of DCs. As such, electronic communication comprising emails, websites and online chat support achieves all planning, collaboration and communication requirements, at a fraction of the cost when compared with traditional channels. However, FG4 argued that, *"DC should have a higher role in dictating CS as it is important to plan the way customers want to be reached rather than using DCs that lower communication costs for the firm."* In a practical view, FG2 responded to this argument pointing out that *'CSs' are adaptable in every situation, and given the limited number of communication channels through which customers want to be reached, it is either that the firm already has a well-developed DC*

in place or uses PNs or low-cost technological solutions with equal effectiveness as traditional methods of distribution." The advent of green or sustainable forms of digital marketing, electronic communication and dispersion of information enables HCCs to acquire TC at a fraction of the cost of traditional channels. Given the paucity of time in the day-to-day lives of consumers, it is only possible to provide delivery of information right to the doorstep. Therefore, it is feasible to say that CS drives DC and not the opposite way around. This relationship is denoted as (A) in cell 3-8.

21. Cell 3-9: Relationship between the DC and RM (A): Input from members in the focus group relating to the driving role of CS on DC is also applicable in the case of RM. This is because HCCs can choose to either adopt a broader framework or a more focussed strategy of communication and acquisition of new TCs, based on the estimates in the RM. According to FG5, *"Revenue logic dictates why a firm undertakes an activity. We need to be clear about the sources of revenue and their time of acquisition so that we can plan ahead. Also, a realisation of revenue from one source is used as investment input within the project. Therefore, RM should be clear for us to operate sustainably."* Business logic invariably makes decisions based on the revenue gathering potential of projects. As FG1 noted that, *"... where sustainable projects have longer timelines for return on investment. So, it makes better sense to invest in credible DCs and accurately assess our revenues over the period."* This indicates that RM has an influential role in the selection and utilisation of DCs over the project lifecycle. The relationship between RM and DC is denoted as (A) in cell 3-9.
22. Cell 4-5: Relationship between the CR and VC (A): Input from members in the focus group recommended a one-way relationship starting from VC. This is due to the commonly held view that formation and establishment of CR is a key activity from the firm's perspective. The type of CR can vary from a highly personal relationship with high customising VP or, in the case when TCs are mainly private enterprises and large scale institutions, to individualise for single-unit homebuyers. Likewise, the relationship can be formal and less interpersonal in government projects. However, FG1 noted that *"establishing and maintaining a relationship with customers is a key activity for HCCs and they must organise resources to ensure stakeholder commitment to agreed goals and the highest level of cooperation."* Likewise, FG2 mentioned, *"distributors need to be*

trained and educated to offer the best customer experience." Although the statement mentioned 'experience' as a term, it was meant to cover all subjects related to VC that go towards the formation of CR. Some of the key activities that were highlighted during the discussion on this point were improvements in HR through education and training on sustainability. The broad view was that sales channels must first learn to acknowledge that produced SVP is not just a product they are supposed to market. They should realise that it is a value they are providing to customers, not just in a financial way through cost savings, but also a social and environmental dimension that most housing projects fail to deliver. The interactive and positive effects of inculcating values in the sales and marketing force could improve consumer attitudes and behaviour while helping them develop trust and mutual understanding between consumer and the HCC. As FG3 said, *"CR should be based on values both parties agree upon in order to work towards fulfilment."* Therefore, it is believed that VCs comprise the establishment of strategic CRs for each customer segment, denoted as (A) in cell 4-5.

23. Cell 4-6: Relationship between the CR and KR (A): Focus group analysis revealed that KRs are the driving force in forming CRs with a variety of TCs. As the results from interviews present a shred of strong evidence combined with input from focus group members, it is safe to correlate KR with CR in a unidirectional relationship. As FG2 said, *"our firm's KR affects the way the company establishes relationships with customers.*" It is clearly understood that a firm's resources can have a direct impact on the nature of the relationships it develops with a customer segment. For example, firms with an online presence (websites, social media, and brand publicity channels) would develop relationships through regular communication with customers through its DCs. The relationship between KR and CR is represented in the matrix as (A) and denoted in cell (4-6).
24. Cell 4-7: Relationship between the CR and PN (A): In the same way as a firm uses its own resources to establish CR, it can use the services of its PNs to create and maintain these relationships where both HCCs and their PN benefit from this activity. As focus groups mentioned the highly specialised nature of businesses today, FG2 and FG4 were of the view that future marketing, sales, customer relationship management and financial exchanges will move towards digital forms. FG4 commented that, *".... either today or*

tomorrow, firms will have to use third-party services for customer communication services, receiving and sending payments, goods and services. Today, customer feedback, reviews and ratings are the most valued currency in the business landscape." The use of PNs by HCCs in collaborative structuring where the partner and the HCC are able to generate value, whether through information, increased customer engagement or financial return, based on the activities they undertake to reach out to customers and form CR, is vital. However, in such cases, PNs, their selection and use have an impact on the nature of the CR it helps to establish. Therefore, the relationship is marked as (A) and denoted in the cell (4-7).

25. Cell 4-8: Relationship between the CR and CS (A): In the light of discussions among members in the focus group, it was clear that CS has an understanding of how the CR works. For example, CS estimates the cost of value creation, delivery and capture. Projects involving the development of a large site into small sustainable VP would be based on establishment of a personal relationship with each TC. Therefore, firms can decide whether to adopt sales-based marketing and relationship management or a digital relationship or a combination of both wherever applicable, to reduce costs and without reducing the extent of CR. This indicates that CS is the driving element in this interaction, and therefore it was denoted as (A) in the above relationship table, which is indicated in cell (4-8).
26. Cell 4-9: Relationship between the CR and RM (A): As indicated in the previous column, RM can impact the formation, selection and implementation of CR strategy within the firm. It was difficult to correlate the impact of RM on CR. However, the revenue model does exert a level of dominance over the workings of the CR, as per the broad opinion. For example, CR that may seem small at the start of the project can turn out to be a large part of the project cost when the project lifecycle view is taken. Therefore, the focus group consensually agreed that RM should drive CR activities and not the other way around. This has been indicated as (A) in cell (4-9).
27. Cell 5-6: Relationship between the VC and KR (X): There was evidence from the discussion that VC and KR are interlinked, which meant that they were driving each other. The focus group discussions presented mixed views as some VCs were dependent on the resources of a firm, whereas some resources dictated the activities that firms

should undertake to create and deliver SVPs. An example of this would be a social low-cost SVP that requires large-scale deployment of solar and water-heating systems. Therefore, KRs of the firm would be technicians for installation of rooftop systems, logistical and transportation vehicles provided by the firm and maintenance professionals under maintenance contracts or PSS contracts. Therefore, traditional firms should renew their KRs to incorporate a change in VCs, as per the SVP agreed upon. As FG2 said, *"energy prices are a major decision-maker in taking up SBM and a SVP, such as renewable energy contracts PSS is a key game changer for our company. Since the technology comes at a price, it has to be well-understood by the customer so that it will have a long-term benefit and the firm will take care of ensuring the quality of service post-deployment."* The argument is crucial since it shows that KRs change when new VCs come into use. Likewise, KRs can also have an impact on VCs where firms compete to be the most sustainable energy solutions provider for example. The interpretation thus derived from the focus group is that there is a dual relationship between VC and KR, which is denoted as (X) in the SSIM and mentioned in cell (5-6).

28. Cell 5-7: Relationship between the VC and PN (V): Partners are sought based on the VCs that should be delivered by the firm to fulfil SVPs. This is based on members' views of the influential nature of VCs for achieving SVPs and selection of partners that help HCCs meet their sustainability orientation objectives in the BM. Although, at the onset, the nature of VC drives PN, in later stages they both compete equally for value creation in their respective spheres. As a word of caution, HCCs were asked not to outsource their critical activities or a large subset of activities leaving little or no control over the management of the entire process. Therefore, changes in VCs would have an impact on the PNs, and not the other way around. This relationship is denoted as (V) in cell 5-7.
29. Cell 5-8: Relationship between the VC and CS (A): The view among focus group members was that CS has a direct impact on the VCs, which is also seen earlier. For example, energy and water prices are a major investment in the housing construction SVPs and firms can choose between different methods of construction, such as off-site development or extensive waste material reuse, besides design level modifications to meet cost imbalances. Thus, the final impact of CS on VC depends on the business objectives, as more cost driven solutions could be replaced by value driven options. This

would generate a premium VP as the customer would be more interested in the delivery of value than the production process and materials used. As costs in the SBM are allocated to each activity and directed towards consumers, keeping the focus on CS would prevent over and under-costing, which minimises the risk that the SVP is priced higher or lower than market expectations. A well-planned CS allows for good budgeting, which can maximise the planning and control of organisations and provide benefits for end-users. In this regard, FG2 said, "*at the end of the day, cost decides consumers' intentions*." Social and environmental benefits are an added benefit, but they only make sense to customers who are aware of sustainability and can see the rising energy prices and labour costs.' Therefore, it is safe to state that CS is a major driver in terms of the VCs undertaken by a firm to fulfil SVPs. This relationship is marked as (A) in cell 5-8.

30. Cell 5-9: Relationship between the VC and RM (V): Discussion on this relationship favoured VC as the decider of RM, which is a statement of how the firm makes money, derives profit and sustains its operational capability over a period of time. The VCs adopted by the firm to configure its value can be assessment and review of systems, life-cycle cost analysis, optimising sustainable production. However, these are outlining methods of revenue generation logic based on value creation activities. LCCA helps firms understand the cost of an asset or a process over time, which helps in processes such as budgeting and other expenses, revenue realisation and profits. The participants agreed unanimously on the impact and driving role of VC on RMs. This is denoted as (V) relationship in cell 5-9.
31. Cell 6-7: Relationship between the KR and PN (V): As mentioned in the relationship of VC and PN, the members in the focus group agreed on the influential role of KR on selection and choice of PNs. Based on the competencies of the parent firm itself, the value promised to customers, and the resources needed to deliver that value, the firm may choose to either develop that resource within the firm or work with a partner. VCs and PNs define different forms of inter-organisational ties in the form of alliances, joint ventures, long-term buyer contracts and buyer-supplier relationships. The firm's network of partners constitutes a part of its VC that has been outsourced and is, therefore, driven by the needs of KR. Although the role of PNs and KRs is to share the responsibility of delivering SVPs, it is essential that they work as a unit once the relationship has been

established. In essence, KR is the major reason for seeking out PNs, which is a relationship denoted as (V) in the matrix under column in cell (6-7).

32. Cell 6-8: Relationship between the KR and CS (A): The participants from the focus group agreed on the uptake of CS as the detrimental factor in the selection of KR in the value creation process of the SBM. This is mainly because the budget allocations need careful allocation strategies to determine the capabilities and VC in the proposed model. The budget is driven by the characteristics of customer needs, therefore KR should be aligned to meet those requirements. The aim of CS control over KR is to produce the highest quality of construction and design processes within the available budget. The relationship direction of the model is self-explanatory according to the following actions. Firstly, decisions taken during design and construction are based on the forecast and its implications for cost must be duly assessed. This would allow consideration of alternatives. Also, no decision should be taken that causes a sharp rise in the total budget or exceeds the proposed budget cost. Secondly, project teams must be encouraged to design within the cost and plan at all stages that allow variation and change in design. It should be communicated that no teams are allowed to increase costs on the element of the work. Increased cost, if necessary, should be offset by balanced savings on another. Therefore, focus group views have made the relationship between CS and KR unidirectional, beginning with CS activities and leading to change in KR. It is denoted as (A) in cell (6-8).
33. Cell 6-9: Relationship between the KR and RM (V): Outcomes of the focus group on KR and RM reveal that there is a one directional relationship between the two elements. KR lists the cost of acquiring, maintaining and using a particular resource, which is represented as an asset or a liability in the revenue model. The view FG1 expressed was that, *"the new relationship requires a list of all the outgoings and in-house resources and considering ways they can be utilised effectively. This brings a creative mindset to the organisation as opposed to traditional linear logic."* The impact of KR on the revenue growth and margin assessment can be seen in the component of overall profit growth over a period of time. For example, purchasing transportation equipment or shipping contracts can save considerable costs for firms using finished goods for construction from off-site factories. However, the profitability would be seen in this

approach when reviewed, based on data for a period of five to ten years. Therefore, KR extends a direct and significant influence on RM, which is denoted as (V) in cell 6-9.

34. Cell 7-8: Relationship between the PN and CS (A): The relationship between PNs and the CS element is reversed. As focus group members indicated, the cost structure, which is a statement of costs involved in delivering SVPs, effects which PNs the firm can leverage to meet and increase the quality of its value offering. A partner is selected according to the careful assessment of costs, and a strategic decision must be made by project managers. As FG2 said, *"some firms will provide us with the same value at a lower cost than you could provide using your firm's resources, in that case it makes sense to partner with such firms and reduce your inventory, which is causing your firm a business loss."* In other words, there is an inevitable degree of push and pull factors that lead to firms deciding which firms to choose as partners. However, FG1 said, *"While CS is an important parameter in selecting PNs, what firms look for is that the overall objective should be the same (i.e., SBMs, SDGs, smart solutions, low-cost energy, etc.)."* Therefore, firms and their partners would have a self-interest driven motivation, but this should not lead to sacrificing value promised to the customer. Based on these views, CS can be a strong driver for changes in PN selection and, thus, sustained value creation. For this reason, the SSIM is marked as (A) and denoted in cell (7-8).
35. Cell 7-9: Relationship between the PN and RM (V): The observation on this relationship was directed by PNs and made an impact on the firm's RM. As focus group members agreed that PN selection, although driven by cost structure, was an opportunity for both firms to realise the value maximisation potential through a collaborative effort. For example, PNs providing a digital platform for communication between CS and HCCs could advertise and earn revenue. Likewise, private institutions (TC), having seen the quality of communication that was originally provided by the HCCs, could seek a direct partnership for another project outside the on-going engagement. Therefore, PNs would receive an extra source of income without spending anything on TC acquisition. According to FG1, *"the approach is to list all outsourced and in-house resources – then think what you can do with them to increase value."* This suggests the evolving nature of PN relationships. Long-term partners would be well-integrated to facilitate larger revenue generations. Therefore, partners, in many ways, help drive RMs by seeking

opportunities for scaling. The direct influence of PN over RM is denoted as (V) in cell (7-9).

36. Cell 8-9: Relationship between the CS and RM (V): In the last relationship of elements CS and RM, participants agreed to the driving nature of CS in the creation of the revenue model. The CS works as an input to the creation of financial logic of which RM is a part. According to FG3, *"SVPs drive increased costs in some areas, and reduced costs and savings in another."* Thus, RM provides a clear understanding of the costs involved and profit opportunities. As FG4 noted that, *"it is also a reason-based relationship since at the end of the year, firms want to see their business growing, for which profitability is a must."* It is safe to assume that CS has an influential role in bringing change to the RM. However, the opposite is not true. Therefore, their relationship is marked (V) in cell 8-9. Final table (6-5) final SSIM represented below.

Table 6-4: Final Structural Self-Interaction Matrix (SSIM)

NO	SBM Elements	1	2	3	4	5	6	7	8	9
1	Sustainable Value Proposition (SVP)	X	X	X	X	V	V	V	V	V
2	Target Customer (TC)	X	X	X	X	V	V	V	V	V
3	Distribution Channels (DC)	X	X	X	X	A	A	A	A	A
4	Customer Relationships (CR)	X	X	X	X	A	A	A	A	A
5	Value Configuration/Key Activities - (VC)	A	A	V	V	X	X	V	A	V
6	Core Capability/Key Resources (KR)	A	A	V	V	X	X	V	A	V
7	Partner Networks (PN)	A	A	V	V	A	A	X	A	V
8	Cost Structure (CS)	A	A	V	V	V	V	V	X	V
9	Revenue Model (RM)	A	A	V	V	A	A	A	A	X

6.4.3. Developing a reachability matrix (RM) from SSIM

The RM was obtained by converting the SSIM into a binary matrix by substituting V, A, X, O by 1 and 0 as per the case. The rules for the substitution of 1s and 0s are as follows:

1. If the (i,j) entry in the SSIM is V, then the (i,j) entry in the reachability matrix becomes 1 and the (j, i) entry becomes 0.

2. If the (i,j) entry in the SSIM is A, then the (i,j) entry in the reachability matrix becomes 0 and the (j, i) entry becomes 1.

3. If the (i,j) entry in the SSIM is X, then the (i,j) entry in the reachability matrix becomes 1 and the (j, i) entry also becomes 1.

4. If the (i,j) entry in the SSIM is O, then the (i,j) entry in the reachability matrix becomes 0 and the (j, i) entry also becomes 0.

In accordance with the rules mentioned above, the Reachability Matrix for a SBM with its elements is presented in table (6-6). As there was no transitivity in the study, the RM will be used in further calculations.

Table 6-5: RM Matrix

NO	SBM Elements	1	2	3	4	5	6	7	8	9
1	Sustainable Value Proposition (SVP)	1	1	1	1	1	1	1	1	1
2	Target Customer (TC)	1	1	1	1	1	1	1	1	1
3	Distribution Channels (DC)	1	1	1	1	0	0	0	0	0
4	Customer Relationships (CR)	1	1	1	1	0	0	0	0	0
5	Value Configuration/Key Activities - (VC)	0	0	1	1	1	1	1	0	1
6	Core Capability/Key Resources (KR)	0	0	1	1	1	1	1	0	1
7	Partner Networks (PN)	0	0	1	1	0	0	1	0	1
8	Cost Structure (CS)	0	0	1	1	1	1	1	1	1
9	Revenue Model (RM)	0	0	1	1	0	0	0	0	1

In the next table (6-6) the final Reachability Matrix is given. This table demonstrates the power and dependence of the elements of the SBM in a single diagram. Therefore, the driving force of the SBM is the presence of all the elements that help to achieve the objectives, whereas dependence is derived from the SBM elements that help in achieving those objectives. According to the driving power and type of dependence, the elements of the SBM are classified into four groups: autonomous, dependent, linkage and independent/drivers. The approach to this classification and its implications is outlined below.

Table 6-6: Final RM with Driving Power and Dependency

NO	SBM Elements	1	2	3	4	5	6	7	8	9	Driver Power
1	Sustainable Value Proposition (SVP)	1	1	1	1	1	1	1	1	1	**9**
2	Target Customer (TC)	1	1	1	1	1	1	1	1	1	**9**
3	Distribution Channels (DC)	1	1	1	1	0	0	0	0	0	**4**
4	Customer Relationships (CR)	1	1	1	1	0	0	0	0	0	**4**
5	Value Configuration (VC)	0	0	1	1	1	1	1	0	1	**6**
6	Key Resources (KR)	0	0	1	1	1	1	1	0	1	**6**
7	Partner Networks (PN)	0	0	1	1	0	0	1	0	1	**4**
8	Cost Structure (CS)	0	0	1	1	1	1	1	1	1	**7**
9	Revenue Model (RM)	0	0	1	1	0	0	0	0	1	**3**
	Dependency	**4**	**4**	**9**	**9**	**5**	**5**	**6**	**3**	**7**	**52/52**

6.3.3 Classifying SBM Elements – MICMAC Analysis

According to the MICMAC analysis, multiple user experiences were drawn by performing a visual analysis of the influential structures. The primary function of this analysis technique is to create influences and dependence between elements and create a classification system that divides these elements into independent, relay/linkage, dependent and autonomous clusters. In accordance with the driving power of each element and its dependence, a table has been generated, as shown in table (6-7). The elements of the SBM are divided into four major groups, as shown in figure (6-1). This type of classification helps to identify the most important elements in the model that drive the SBMs transformation and development. While evaluating the driving factors and dependence on other elements, a graph is plotted classifying each factor into four clusters.

Table 6-7: Driving Power and Dependence Power for the SBM Elements

SBM Elements	Number	Driver Power	Dependency
Sustainable Value Proposition (SVP)	1	9	4
Target Customer (TC)	2	9	4
Distribution Channels (DC)	3	4	9
Customer Relationships (CR)	4	4	9
Value Configuration/Key Activities - (VC)	5	6	5
Core Capability/Key Resources (KR)	6	6	5
Partner Networks (PN)	7	4	6
Cost Structure (CS)	8	7	3
Revenue Model (RM)	9	3	7

Each element in the matrix is represented as a point on the x-y coordinate system. As an example, for an element that has a driver power of 9 units and dependence power of 4 units, the element will be placed in the fourth cluster and considered an independent factor. For this study, SBM elements are placed in their respective clusters, as shown in figure (6-2). The clusters are as follows:

- Autonomous Elements: Total 0 elements located at this cluster.

The elements that are autonomous or excluded have little influence and minimal dependence. These elements are rather segregated and thus excluded from the global dynamics of the model since there is no major impact of these elements or advantage in the SBM transformation. They can act as secondary variables and even as application points for the possible accompanying measures. The ISM analysis of the elements in the SBM has failed to show any elements located in this segment.

- Dependent Elements: Four elements are located in this cluster: Distribution Channel (3rd Element), Customer Relationship (4th Element), Partner Networks (7th Element) and Revenue Model (9th Element).

Dependent elements have minor impact on the entire SBM and thus exist as dependent entities. Their existence is highly sensitive to the evolution of independent factors. Thus, it is likely they will be viewed as exit variables from the system.

- Linkage Elements: Two elements located in this cluster: Value Configurations (5th Element) and Capabilities (6th Element).

The behaviour of the elements classified under this group is high dependence and motivations. Thus, they are susceptible to other elements and generate self-feedback.

- Independent Elements: Three elements located in this cluster: Sustainable Value Proposition (1st Element), Target Customers and (2nd Elements) and Cost Structure (8th Elements).

The classification of independent elements in this group is also critical and shows very little dependence. This group is crucial since it affects the entire system and exerts influence on other groups. This group tends to control the dynamics of dependent, autonomous and linkage factors; therefore, the system considers them as entry-level elements into the system. In general, the system exerts no external control over these factors. However, this group collectively can act as a factor of inertia.

Driver Power										
9					1,2					
8										
7				8						
6						5,6				
5										
4							7			3,4
3								9		
2										
1										
0										
	0	1	2	3	4	5	6	7	8	9
	Dependency									

Fig 6-1: MICMAC Analysis

The major findings of this classification figure (6-2) are as follows:

1. Three elements SVP, TC and CS were identified in the analysis as drivers or independent elements for the implementation of the SBM in the Saudi HCI for this study. These elements are given significant importance in the system and therefore considered as elements that extend a high level of influence on the overall system in particular (Shi et al., 2015). Likewise, the elements classified as independent should have higher levels of priority in the implementation and transformation of the SBM. This would lead to improved outcomes in the transformations required to achieve the desired objectives and, thus, these elements mandate special attention.
2. Elements such as VC and KR are considered as linkage elements, which have a strong dependence on the independent elements and thus exert a high driving force in the entire

model. This is an indicator of a strong link between the elements. Therefore, it is necessary to consider them as clubbed elements. As the nature of relationships among these elements is quite high, modification in one element may cause vulnerabilities in the other elements, and so on.

3. The elements of DC, CR, PN and RM are considered weak drivers of the entire system, but they have strong dependence with the remaining elements in the model. The abovementioned elements have a significant scope for improvement, and they can be easily influenced, which occurs due to changes in the independent elements in the ISM model. In order to improve the sustainability of the BM and create transformations, these elements should be impacted through the changes made in the independent elements, which are SVP, TC and CS. This is quite interesting as it is possible to understand the key areas that a business needs to work upon in order to exert influence on the rest of the BM. Likewise, the business motivation should move in the direction of examining the efficiency of DC, CR and PN elements under the dynamic conditions of projects and their management to ensure fulfilment of sustainable models.
4. The findings indicate absence of any element in the autonomous cluster. The elements that would be classified in this category are considered as weak drivers of the entire system and showing poor dependence on other elements as well as the nature of the relationships they extend. As none of the elements fall in this category, the findings indicate that the SBM elements have moderate to strong linkages among themselves and independent factors are strongly connected with linkage group elements. Thus, the entire system is properly connected and functions as a single unit.

6.3.4 Level Partitions

The step after the development of an ISM model is removal of the sequential ordering as seen in the reachability matrix by using level partitioning (Warfield, 1974). The goal at this stage is to create a digraph based on inputs from the final reachability matrix. The level partition has groups that are related to every element (sj) in (s). Based on the findings of Warfield (1974) and Farris and Sage (1977), use of the final reachability matrix helps in the creation of the set of factors on which a particular element is dependent. Final reachability matrix also helps in the calculation of reachability.

In the reachability set R(s_i) for a specific factor s_i is the group of elements described within the columns, which include one in row s_i and this is included factor itself, in addition to the other elements that are accessible from s_i. Likewise, the antecedent A(s_i) of the element s_i includes the set of factors described within the rows that include 1 in the column s_i and it is included in the element itself, as well as the other factors that may reach the element s_i comprising the antecedent set A(s_i). Afterwards, realising the reachability set and antecedent set for all factors, the intersection for these sets (the common elements in both sets R(s_i) ∩ A(s_i) is derived for all the elements. The element for which R(s_i) = R(s_i) ∩ A(s_i) includes the top-level factor within the ISM hierarchy.

Then the first iteration, (element 3) Distribution Channels, (element 4) Customer Relationship were found to be the top-level factor, and this has less association with any other factors over its own level, see table (6-8). As soon as the top-level factor is recognised, it is removed from the other remaining elements. Then, the same iterative process continues until the level of all elements is achieved (until the levels of each element are determined).

Table 6-8: Iteration 1

	Elements	Reachability set	Antecedent Intersect	Intersection set	Leve l
1	Sustainable Value Proposition (SVP)	1.2.3.4.5.6.7.8.9	1.2.3.4	1.2.3.4	
2	Target Customer (TC)	1.2.3.4.5.6.7.8.9	1.2.3.4	1.2.3.4	
3	Distribution Channels (DC)	1.2.3.4	1.2.3.4.5.6.7.8.9	1.2.3.4	1
4	Customer Relationships (CR)	1.2.3.4	1.2.3.4.5.6.7.8.9	1.2.3.4	1
5	Value Configuration (VC)	3.4.5.6.7.9	1.2.5.6.8	5.6.	
6	Key Resources (KR)	3.4.5.6.7.9	1.2.5.6.8	5.6	
7	Partner Networks (PN)	3.4.7.9	1.2.5.6.7.8	7	
8	Cost Structure (CS)	3.4.5.6.7.8.9	1.2.8	8	
9	Revenue Model (RM)	3.4.9	1.2.5.6.7.8.9	9	

The second iteration, table (6-9), led to (element 9) Revenue Model. For the third iteration table (6-10), (element 9) Partner Network was removed and placed at Level 3. In the fourth iteration table (6-11), (element 5) Value Configuration and (element 6) Key Resources were removed and placed at Level 4. For the fifth iteration table (6-12), (element 8) Cost Structure was removed and placed at Level 5. In the sixth and final iteration table (6.13), the last two remaining elements, (element 1) Sustainable Value Proposition, (element 2) Target Customers had the same reachability and intersection sets; accordingly, they were assigned to Level 6. The levels so determined helped in building the digraph and the final model of ISM.

Table 6-9: Iteration 2

	Elements	Reachability set	Antecedents Intersect	Intersection set	Level
1	Sustainable Value Proposition (SVP)	1.2.5.6.7.8.9	1.2.	1.2	
2	Target Customer (TC)	1.2.5.6.7.8.9	1.2.	1.2	
5	Value Configuration (VC)	5.6.7.9	1.2.5.6.8	5.6.	
6	Key Resources (KR)	5.6.7.9	1.2.5.6.8	5.6	
7	Partner Networks (PN)	7.9	1.2.5.6.7.8	7	
8	Cost Structure (CS)	5.6.7.8.9	1.2.8	8	
9	Revenue Model (RM)	9	1.2.5.6.7.8.9	9	2

Table 6-10: Iteration 3

	Elements	Reachability set	Antecedents Intersect	Intersection set	Level
1	Sustainable Value Proposition (SVP)	1.2.5.6.7.8	1.2.	1.2	
2	Target Customer (TC)	1.2.5.6.7.8	1.2.	1.2	
5	Value Configuration (VC)	5.6.7	1.2.5.6.8	5.6.	
6	Key Resources (KR)	5.6.7	1.2.5.6.8	5.6	
7	Partner Networks (PN)	7	1.2.5.6.7.8	7	3
8	Cost Structure (CS)	5.6.7.8	1.2.8	8	

Table 6-11: Iteration 4

	Elements	Reachability set	Antecedents Intersect	Intersection set	Level
1	Sustainable Value Proposition (SVP)	1.2.5.6.7.8	1.2.	1.2	
2	Target Customer (TC)	1.2.5.6.7.8	1.2.	1.2	
5	Value Configuration (VC)	5.6.7	1.2.5.6.8	5.6.	4
6	Key Resources (KR)	5.6.7	1.2.5.6.8	5.6	4
8	Cost Structure (CS)	5.6.7.8	1.2.8	8	

Table 6-12: Iteration 5

	Elements	Reachability set	Antecedents Intersect	Intersection set	Level
1	Sustainable Value Proposition (SVP)	1.2.8	1.2.	1.2	
2	Target Customer (TC)	1.2.8	1.2.	1.2	
8	Cost Structure (CS)	8	1.2.8	8	5

Table 6-13: Iteration 5

	Elements	Reachability set	Antecedents Intersect	Intersection set	Level
1	Sustainable Value Proposition (SVP)	1.2	1.2.	1.2	6
2	Target Customer (TC)	1.2	1.2.	1.2	6

The level identification process of these elements was completed in six iterations (table 6-8 to 6-13). The identified levels for each factor, (summarised in table 6-14) help in building the digraph and final ISM model.

Table 6-14: Summary of Elements Levels

level	Elements	Number ID
1	Distribution Channels (DC)	3
	Customer Relationships (CR)	4
2	Revenue Model (RM)	9
3	Partner Networks (PN)	7
4	Value Configuration (VC)	5
	Key Resources (KR)	6
5	Cost Structure (CS)	8
6	Target Customer (TC)	2
	Sustainable Value Proposition (SVP)	1

6.3.5 Developing the ISM-Based Model

According to the conical matrix, the initial digraph showing transitivity connections is achieved. It is produced by creating the nodes and lines of the edge. After the extraction of the indirect connections, the structure of the final diagraph can be established; this is further transformed into the ISM model through the substitution of nodes in each factors of the statement figure (6-3). This gives the complete representation of the inter-relationships that exist among the elements.

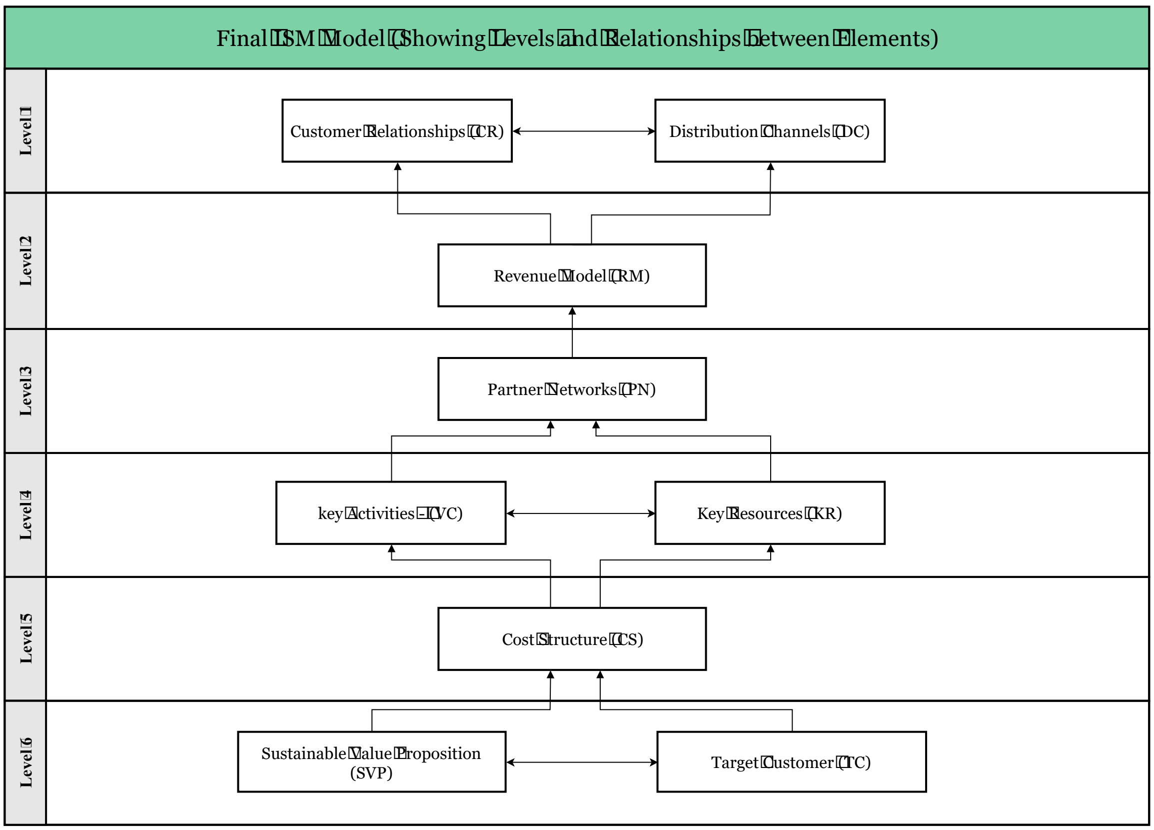

Fig 6-2: Final ISM Model (Showing Levels and Relationships between Elements)

The ISM model denotes the interrelationships that exist among the elements, which are identified and use unidirectional and bidirectional arrows to mark their relationships and dependencies. The top-level factors are placed at the top of the diagraph and second level factors are placed below in the hierarchy. The final or bottom level factors are placed at the end of the hierarchy see figure (6-3). The model can be read from bottom to top processing and the elements located at level 6 have the highest drive, which can form the basis for top management when developing SBMs.

6.3.6 ISM Model Description

The final diagraph generated through the ISM is a hierarchical structure of elements of the SBM. The diagraph extends a major understanding of the SBM transformations to the practitioners of HCCs. It helps them understand the nature of relationships between each element in the SBM and leads senior management professionals and decision makers to create a more realistic representation of the concept as they transform their BMs into SBMs within their organisational ecosystems.

Another contribution of the model is to establish the contextual associations that exist among the elements identified in the SBM. As the framework presents the dynamically associated elements within a single structure, its application emerges from observing the relationships among these elements, the order and direction of the elements, which serve as inputs and outputs to the entire framework. The flow of information between elements drives the decision-making potential of the management in HCCs. Practitioners can use their available resources effectively to maximise the element tasks in their organisations. The elements have been created from literature, modelled in the same way that scholars have presented these elements and argued about their efficacy. In the ISM, these elements are represented according to their driving forces and dependence powers. Therefore, elements that exert a higher driving force can be located at the bottom of the ISM model and should be addressed according to their priority.

The direction of arrows can indicate the relationship between different elements. As an example, the bi-directional relationship between the different elements; for example, the relationship between SVP and TC is a two-way relationship. This is further explained in cell 1-2. Therefore, the arrow that points in both directions can be used to denote this relationship. However, it is seen that the relationship between SVP and CS is unidirectional. This means SVP is the driver of CS and thus an arrow with a single direction is used. The ISM approach generated six levels of connectedness among elements, which are discussed in more detail.

First, the results show that SVP along with TC are the most important to change when developing SBM. These elements are not just important but also difficult for firms to change. Firms must figure out demand, customer needs and what is wanted of the end products in order to convert them into SVPs that adhere to principles of economic, environmental and social sustainability. When they have a correctly mapped and organised set of TC needs, firms would have to analyse the CS of meeting those needs and whether their VCs and KRs allow them to fulfil such needs below market prices. In the case of VCs and KRs not able to deliver TC needs or where the cost is high when delivering customer needs, firms will engage PN to reduce costs as much as possible. When firms are able to analyse CS, KRs, VCs and PNs needed to deliver SVPs, they will examine their RM so that more opportunities can be created to generate revenue streams and bundle those ideas within the SVP. A clear understanding of RM will help firms to utilise the right DC and CR methods for each CS.

To meet customer needs through a value proposition that is sustainable requires an accurate estimation of resources going towards the fulfilment of the value promised to the TC. Therefore, the SBM view emerges from an understanding of volatility in key construction resource markets; for example, energy utilisation costing, land pricing, workforce availability, financial credit lines, increasing construction material costs and decreasing quality of construction materials. Using traditional methods of construction for the fulfilment of customer needs is becoming increasingly difficult and costly for HCCs. Firms will find it increasingly difficult to serve SVPs using old methods of VCs and KR alignment with business objectives. Given the new methods of construction, which reduce waste and employ fewer resources than traditional methods, this will bring cost savings in the RM and final prices to consumers will be reduced, thus making housing more affordable. Construction using traditional methods is not only unsustainable, but it puts construction firms at even greater risk of financial losses and decline in profitability.

Therefore, HCCs must move towards SVPs that promises TC with products and services that are fulfilled using renewable sources whose prices can be predicted safely. HCCs must design SVPs in a way that best estimates the CS with minimum variability. This approach reduces the chances of budget overshoots when VCs and KRs are aligned to create and deliver value. Similarly, SVP-driven CS allows HCCs to be diligent in selecting their partners. Lastly, SVPs capable of delivering low-cost, energy-efficient and community-based housing will promote the development of strong CR, which HCCs or its PNs can use in future to target the same customer with a range of SVPs during the product lifecycle.

With increasing use of technology in every sphere of knowledge, customer relationship marketing is significantly benefitting and helping to reduce the cost of communication even further. Likewise, it is turning distribution channels into digital platforms, while HCCs are incentivising consumers to communicate through online channels instead of physical engagement, which requires arrangements for transport, office space and additional resources. Technology is having a moderating effect on other elements in the SBM. For example, market segments are being generated based on Big Data Analytics Access (BDAA). KRs and VCs are increasingly relying on technology-based tools over HR functions. RM estimations are being performed through computer software-based tools. As a result, lower level functions, such as DC and CR are also being transformed, using available technology.

6.3.7 Discussion

This section discusses the importance of each element of the SBM and confirms the relationship of each element in relation to other elements in the model. The connectedness of the framework and interrelationships between different elements of the framework strengthens its utility as a complete description of the business explained with the help of a SBM. According to Magretta (2002), a BM should be considered a whole system instead of isolated elements. This was later confirmed by Pekuri et al. (2015) and Abuzeinab (2015). The importance of a SBM as a planning tool is due to the existence and interplay of all the elements that fit into a functional model, describing all business activities in a single diagram. This study has presented the relationships between different SBM elements using a novel approach that serves as a practical guide for the HCI businesses in understanding and transforming their BMs into SBMs. The validity of this practice comes from the empirical analysis used to develop ISM and its wide acceptance in construction, renewable energy, sustainable development and design-based industries as a tool to establish relationships and interconnectedness among a set of unrelated items. The driver-dependence diagram figure (6.2) supports the ISM validation method since there were no autonomous elements found to have any disconnections from the system. Therefore, all elements identified in the SBM framework have influence in this value-driven model, and a lack of autonomous elements validated this assumption through ISM techniques. The outcome of this task is to let management give due importance to each element of the SBM framework. The application of ISM in the design of a SBM was to impose order and direction among the elements while measuring the complexity of relationships among them.

Identification of SVP and TC as the most critical elements in the SBM framework has been highlighted through ISM analysis in previous studies, such as Teece (2010), Mokhlesian (2012) and Pekuri et al. (2015). This is because every BM involves discovering, understanding and refining a market segment. In this typology, Baden-Fuller and Mangematin (2013) identify VP as the most important factor or element on which all activities of the firm and its networks are placed. Likewise, Abuzeinab (2015) demonstrated how GVP and financial logic are the driving elements in GBM transformations. Therefore, SVPs, like the light from a torch, are ignited when VPs are accepted by consumers. It is necessary, therefore, to consider SVPs the major factor in fulfilment of the needs of a TC. Both elements must exhibit a high level of synergy, thus enabling HCCs to successfully deliver SVPs.

Secondly, value delivery methods should encompass delivery of the major part of the promised value at the time desired by the TC. As SBMs framework encourages value delivery and capture of mechanisms at later stages of the product lifecycle, they should be clearly stated upfront. Likewise, the social and environmental impacts of activity or value should be provided for consumers as measures of awareness. Whether the value is monetary or non-monetary, it becomes crucial to understand and assess all factors that contribute to the development of that value and link all such activities to their economic, social and environmental impacts. HCCs can reduce or eliminate the impact of their activities only through careful assessment of the firm responsible for delivering value to a TC. For example, the research by Zhao & Pan (2015) using the ZCB approach presents an opportunity for companies operating in the sector of land retail, energy appliances, energy production, renewable and refurbished construction materials to join hands and accelerate the uptake of the ZCB approach. Likewise, financial firms can support ZCB development by providing secure loans to developers and consumers at attractive rates. Similarly, financial institutions can encourage the development of offices, educational institutions and supporting community infrastructure using the same ZCB approach. The sustainable value network and partner network are innovative components of the SBM.

In conclusion, a BM is a great planning tool because it focusses on the elements and how they fit together into a system, working together to support the business. The sustainability concept introduced into the BM design is shaped by an understanding of uncertainties and trends in the HCI, which may indicate increases in price of certain commodities driven by a range of political, environmental, social, technological, economic and legal issues. Although it is difficult to list all such factors, it is found that they can cumulatively impact BMs, sometimes placing firms at risk of exhausting their resources. The SBM framework is aimed at lowering economic costs of development and environmental impacts at all stages of a project lifecycle while increasing social capital development activities. To achieve this task, the SBM framework reviews the firm’s competencies, engages like-minded partners, shares risk and rewards during the entire project lifecycle. The SBM framework ensures that its VP respects triple bottom line principles and meets TC needs at the same time. Therefore, it is a value creation mechanism that places customer needs as the driving force to engage its resources and partners in a way that helps in the fulfilment of customer needs, with minimum environmental impact and generation of revenue for the firm and its partners. A similar approach for the identification of the relationship between the challenges associated with SBM framework implementation presented next.

6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8
Introduction	Focus Group Profile	ISM Modelling SBM Implementation Framework	ISM for SBM Challenges	Practical Guidelines for Managers	Validation	Recommendations	Summary

6.4 ISM for SBM challenges:

This section presents a model for the SBM challenges, listing the challenges and an overview. The section applies the same rules as those found in section 6.4 and its subsections. During first phase of collecting the data it became clear that there is a structure relationship between the challenges facing the implementation, but it was not very clear. Therefore, a step further was taken to present theses relationship to identify the root challenges. The findings from the focus group highlight the clear relationships between factors that pose a challenge for HCCs attempting SBM transformation. The ISM approach provides a structure for presenting these relationships. The steps used in the development of ISM are presented below.

6.4.1 Identifying SBM challenges

Based on participant input, several challenges to the SBM transformations have been identified, as highlighted in the previous chapter. These challenges are classified into six categories and shown in table (6-16) below:

Table 6-15: SBM challenges

No	Type of Challenges	Description
1	Political	Policy coverage and regulations at all levels. Areas such as global environmental agreements, from proposal to acceptance and implementation at grassroots. Covers implications at different levels of planning, such as municipal level, organisational planning level, community planning level, etc.
2	Economical	Describes the issues associated with regional, national or global economy on a macroeconomic level, which can lead to a decline in factors of production or affect policymaking at an organisational level during SBM transformation.
3	Socio-Cultural	Includes sharing of beliefs, attitudes of the population and marketing management knowledge about consumers and their understanding.
4	Technological/ Technical	Includes areas such as methods of production, provision of services, distribution, and communication with target markets.
5	Environmental	Describes present issues in the environment, the impact of companies on the environment at micro and macro levels. Covers a broad spectrum of issues relating to the environment and presents environmentally friendly firms.
6	Legal	Includes legal implications and how legislation driven by other factors (political, environmental, socio-cultural, economic) affects business strategy and SBM transformation.

6.4.2 Developing SSIM for SBM challenges

Analysis of the focus group identifies existing pair-wise relationships between two factors. According to the analysis, a word such as ‘alleviate’ is chosen to describe the contextual relationship as well as use of four symbols to indicate the direction of the relationship between any two given challenges or factors (i and j).

1. X: i and j alleviate each other or mutually dependent.
2. V: i alleviate j or forward dependent.
3. A: j alleviates i or backward dependent.
4. O: i and j unrelated or mutually independent.

Table (6-16) below shows the SSIM representation of the challenges and the relevant pair-wise relationships between any two given challenges.

Table 6-16: SSIM for SBM challenges

NO	Type of Challenges	1	2	3	4	5	6
1	Political	X	X	A	V	X	X
2	Economical		X	X	X	X	X
3	Social			X	V	V	X
4	Tech/Technical				X	X	A
5	Environmental					X	X
6	Legal						X

The challenges reported during the focus group phase were found to have an impact on each other and no challenge was found to be unrelated (O) during the development of SSIM. For this reason, an ISM analysis was conducted to provide a justification for the challenges and to identify the source challenges. This exercise would allow channelling of resources and efforts to alleviate those challenges before applying efforts to eradicate challenges in other areas.

The contextual challenges of the SBM framework were taken from the analysis of interviews presented in earlier chapters. Table (6-16), presented earlier, illustrates each challenge and its influence on others, as explained for each cell number. Broad analysis of the focus group reveals social challenges, in terms of awareness, lack of acceptance and knowledge about quality and performance of sustainable products in the market, as presenting a major challenge for SBM transformation by the HCCs. As such, focus group participants shared difficulties in satisfying consumer needs through SVPs, as consumers revealed inhibitions and limitations in relation to acceptance of a socio-environment-friendly model. While the top management assured consumers of their commitment to providing seamless comfort and energy during the project lifecycle, market uncertainties and lack of consumer trust, along with absence of legal recourse, created a vacuum that HCCs were unable to resolve. As the focus group maintained that consumer behaviour was shaped, not only by single factors, such as education, or weak legal resolutions for consumers, but by a range of factors that affect consumer decision-making, it was important to analyse which challenges in combination have a higher potential for changing consumer mindsets. These are analysed and reported, based on discussions with focus group members, in the 15 cells below:

1. Cell 1-2: Relationship between the political and economic challenges (X): The response from focus group members indicated a bi-directional relationship between the two elements. For example, a highly subsidised conventional source of energy, such as oil, discourages political leaders from discontinuing practices, despite being under international pressures to adopt cleaner modes of energy generation. This fear arises from changes that transition companies dependent on oil for production and manufacturing, consumers reliant on oil-based products and the economy, in general, would have to face if the government placed restrictions on energy production using readily available crude oil. According to FG1, *"… we see that see that if the government places high restrictions on oil, the economy will slow down and people will suffer before the economy stabilises again with renewable infrastructure in place."* Therefore, lack of political commitment is a major impediment to transformation of an economy dependent on conventional sources of renewables. Another comment by FG2 was, *"there should be a common consensus between political and business leaders to gradually move towards a cleaner form of production."* This is an important statement since sustainable or green business in the HCI faces major barriers due to lack of political commitment. The government could choose to allow foreign investors to introduce renewable technology into the country through partnerships with public institutions and establish long-term leases for

operations. Likewise, the private sector could be encouraged to innovate as they already possess information about local consumer characteristics and environmental conditions. According to FG4, *"private sector must be encouraged to engage in socio-environmental investments with government support to devolve risk."* Other examples of political and economic convergence to resolve barriers to SBM adoption were ease funding for SBMs (FG2), convincing top management to try sustainable practices in public-private partnership projects (FG1) and encouraging sustainability-driven culture at grassroots levels (FG5). According to FG2, *"the government must gradually shape the consumer market and educate consumers through incentives, educational programs and environmental protection laws such that it supports sustainable housing development and construction markets, enabling preparation of SVPs that attract TCs."* Therefore, it is evident that political and economic challenges influence each other and a combined effort to tackle them by encouraging policymakers and business leaders to join hands to educate consumers and slowly uptake sustainable practices would create a soothing effect. Thus, the relationship was marked as (X) in cell (1-2).

2. Cell 1-3: Relationship between political and social challenges (A): Inputs from focus group participants revealed social pressure as the driving force for political restraint in adoption of sustainable solutions. For example, the major factor influencing social disapproval of renewable energy and environmental solutions in HC stemmed from consumer issues. According to FG3, *"first, consumers want their most important needs from housing to be met in a special design and environment. When HCCs can deliver that successfully, consumers will become open to innovative ideas and sustainable solutions."* This is an important observation, since the BMs of traditional housing markets are driven largely by build-and-sell models which drive down costs of real estate in a bid to target consumers. As HCCs have been unwilling to take long-term contractual responsibility for management of their products, consumers are sceptical about the quality of housing and thus unreceptive to sustainable products. Another reason for the lack of social interest in sustainable development is the fragmented nature of institutions responsible for managing the assessment of environmental and social impacts. When firms responsible for managing environmental issues remain passive, it affects the overall policymaking agenda and is one of the reasons for slow movement towards environmental protection

and sustainability in a broad sense. FG4 commented that, *"People need to educate themselves about the harm housing is causing to the environment, and they should be supported by the government to move towards eco-friendly development."* In general, it was a combination of social issues, such as lack of awareness, knowledge and acceptance of sustainable development in the society, that reverberated in political meetings and thus shaped the annual agenda. Therefore, social challenges are deemed an influencing agent of political challenge and accordingly marked (A) in cell 1-3.

3. Cell 1-4: Relationship between the political and technological/technical challenges (V): Participants emphasised the importance of policies that aid in overcoming adoption of technology. For example, political support for sustainability assessment and building safety codes would directly impact challenges to technology adoption. Countries with sophisticated technologies for housing construction, material refurbishment and energy generation could be allowed to enter and operate, as it would allow foreign firms to share most of the investment risks while the benefits would be targeted towards the local economy. According to FG3, *"acceptance of any technology will require politically-backed support from the government so that the consumer is assured of the investment."* New and upcoming technologies for environmental impact reduction in the HCI may struggle to transform into large-scale solutions due to the absence of government and private investments, seed funding and restrictions placed by political institutions. According to FG1, *"Saudi Arabia and GCC countries need to embrace the reforms emerging in the domain of business environments and provide appropriate financial incentives and open policy doors to attract the right type of financing instrument that could rapidly enhance environmental technologies in the middle-east region."* Therefore, political challenges have a direct influence on the growth of technological integration within the housing construction industry. Their relationship is indicated as (V) and marked in cell 1-4.
4. Cell 1-5: Relationship between political and environmental challenges (X): The increasing conflux of political and environmental challenges and a driver of policymaking were reported by focus group members. As such, international treaties on environmental degradation leading to concerted efforts to sustain and revive ecological hotspots and prevent further damage to the environment from anthropological activities are seen.

According to FG4, *"environmental concerns are in the limelight in many political conferences in KSA and globally. The harsh and arid climate of our country makes a strong business case for turning to renewable energy while reducing our dependence on oil as this will impact all the countries, especially those in equatorial regions, as the first major signs of global warming are already visible."* Therefore, government restrictions on oil exports should be met with a decrease in the production of oil and an increase in the demand for environment-friendly technologies. The above approach when incentivised and led at the front by the government will impact consumer behaviour and gain global appreciation, resulting in help and support for oil-dependent economies. Considering that development should not come at the cost of environment dilapidation; political and environmental leaders must be willing to uptake the issues of consumers at local levels so that pro-environment policy change does not have a major impact on the lives of consumers on lower economic levels. Thus, as suggested by the focus group members, political and environmental challenges are interrelated, so this was marked with an (X) and denoted in cell 1-5.

5. Cell 1-6: Relationship between the political and legal challenges (X): According to the focus group, political and legal issues are motivated by a lack of active participation by the opposing groups. FG5 explained that saying, *"political leaders aren't working to reduce oil export and income generated from oil as there are no sustainable alternatives for owners of oil companies. They fear being involved in costly lawsuits resulting from tough policies on oil companies. At the same time, oil companies have started to realise the increasing pressures and have made considerable investments in setting up clean energy contracts with local agencies."* This is important because corporations dealing in oil exports, production and manufacturing will require a safe transition period to convert their business into clean energy production. FG2 argues that, *"for SBMs to become a reality, there has to be more cooperation from government and supporting institutions to carry out an assessment of generation potential for solar, wind, tidal and other forms of energy for every region in the country. Thus, those companies will face legal hurdles in order to carry out those activities unless the government provides support."* Political challenges involve the effective application of environmental laws combined with alternative resolutions for people, institutions and companies affected by their

implementation. Thus, there is an urgent need to address the necessary institutional and regulatory weaknesses while also reforming the regulatory framework and restricting institutional arrangements. In summary, the participants were convinced that the political and legal challenges were interlinked and influenced each other, thus this relationship is marked (X) and denoted accordingly in cell 1-6.

6. Cell 2-3: Relationship between Economic and social challenges (X): The views expressed by participants led to the understanding that economic and social issues relating to SBM adoption were interrelated and to some degree influenced each other. While it was felt that social issues had greater impact on the economic side of housing construction and subsequent SBM transformation, FG2 noted that, *"the culture of sustainability will be welcomed when the consumer understands the hidden costs behind every product. These costs are borne by the environment and partially by the consumer by not realising the long-term effects of their decisions."* It was found that high upfront costs were a major reason for negativity among consumers, which impacted the sustainability agenda. Therefore, participants in the focus group welcomed the idea of LCCA and projections for the long-term viability of projects. Likewise, changing consumer attitudes and encouraging a smart lifestyle was recommended so that consumers would be aware of wastage of energy and water; both essential commodities. FG1 stated, *"The TC can be derived not only from considering consumer earnings but also their knowledge of sustainability issues so that likeminded consumers can be targeted for the sale of sustainable products."* In a similar vein, FG5 commented that, *"customer involvement and participation is crucial to their segmentation, as this determines the success or failure of the SBM in the HCI."* For customers to see value being generated from HCC, whether in terms of cost savings or social capital, it is necessary to engage representatives of the TCs to take the lead in managing issues that emerge in housing during the project lifecycle. Also, lack of awareness of sustainable practices should be met with increased educational avenues for consumers so that other possible issues that may arise from misconceptions can be alleviated. Therefore, the relationships between economic and social challenges were interlinked, according to the responses from focus group members, and thus marked (X) in cell 2-3.

7. Cell 2-4: Relationship between Economic and Technological/technical challenges (X): Based on responses from the focus group participants, it is clear that economic and technological challenges drive each other. For example, as FG1 pointed out, *"technology is a game changer for the way information drives decision-making and investments."* Technology-based applications allow firms to evaluate markets with improved analytical skills and rich data. As technology is costly for small and medium scale HCCs, its adoption is limited to large scale companies. Therefore, success in the HCI, which essentially depends on knowledge of the customer and their requirements, is achieved by companies that can invest in technology. Similarly, technology could drive mapping of customer solutions using informational graphics, 3-D designs and replicas of smart homes, which provide the consumer with better understanding of whether the firm would be able to meet its requirements in housing. Therefore, firms with limited capital must find ways to engage the consumer in the value creation process; whether through the acquisition of KRs or using PNs, to engage them in the process, using an online platform and interface as an example. As FG3 said, *"our firm adopted LCCA and ICT tools to provide managers with comprehensive cost information."* Therefore, cost estimation and analysis using technology provides a competitive edge to managers developing CS and RMs to better guide SVPs targeted towards a customer segment. The relationship between economic and technological challenges is, therefore, marked (X) and denoted in cell 2-4.
8. Cell 2-5: Relationship between the economic and environmental challenges (X): The views among focus group members largely supported a mutually dependent relationship between economic and environmental challenges. For example, developing zero carbon housing solutions requires investments that drain financial resources of HCCs, but it provides low maintenance costs, certifications on environmental sustainability and high reputations in the market, which makes it a selling factor for the right TC segment. Therefore, HCCs with limited financial resources will need to arrange partners before developing energy-efficient buildings. While economic challenges drive environmental challenges, some factors associated with the environment also create challenges for the economic model. For example, projects in arid areas of KSA will demand a higher number of resources, depending on the business model. Likewise, development around or near ecologically sensitive zones will have a greater number of restrictions imposed by the

government and environmental protection agencies to protect the natural habitat – thus needing a greater number of resources to balance the effect. HCCs would have to improve its environmental strategy to stay in the sustainability business. Therefore, pursuing an environmental-friendly strategy may need upfront costs that are later recovered during the project lifecycle. Likewise, the CS of a HCC, in relation to a given SVP and its underlying RM, will have a bearing on the type of project a HCC can develop. As economic and environmental challenges are interrelated to an extent, as seen in focus group discussions, their relationship is marked as (X) and denoted in cell 2-5.

9. Cell 2-6: Relationship between economic and legal challenges (X): According to focus group participants, economic and legal challenges are mutually dependent, as the financial incentives and guarantees are key instruments for growth in SBM investments. SBM adoption is considered possible in an appropriate legal environment and policymaking structure that systematically reduces unethical methods of production and development. Development of petroleum research institutes, such as King Abdullah Petroleum Studies and Research Centre (KAPSARC) and King Abdullah Economic City (KAEC) are some of the investments that have nudged the government into developing a proactive policy and adopting a new legalising framework. FG3 argues that, *"… business cannot solve problems that the government is incapable of solving."* Therefore, there is a need for partnership between government and businesses in a PPP relationship to alleviate legal hurdles and improve economic conditions for sustainable development. In this regard, FG2 pointed out that, *"government efforts combined with consistent regulations will remove economic and financial challenges and thus promote market transformation as a whole for a sustainable future."* Therefore, economic challenges in SBMs adoption arise from absence of a supportive legal framework, and vice versa. According to FG5, *'other countries have benefitted from changing their laws, thus incentivising the economy to shift towards sustainable ways of conducting business activities."* Based on the summaries of focus group members, it is believed that economic and legal issues are interrelated and dependent; thus, this relationship is marked (X) and denoted in cell 2-6.
10. Cell 3-4: Relationship between social and technological/technical challenges (V): The response from focus group members favoured the driving force of the social element on technological issues. For example, FG1 explained that, "*HCI professionals tasked with*

value creation have limited knowledge on design of sustainable products or use of environment-friendly methods of construction." Therefore, lack of awareness of sustainable solutions, arising from socio-cultural limitations, causes firms to use sub-standard materials and employ unsustainable methods of design and construction, which ultimately fails TC needs. Ongoing FG1 argued that, *"new technology is not the answer to consumer problems but meets the needs on the demand side as well as TC needs."* The adoption of sustainable designs, LCCA, new methods of construction practices and green materials is hindered by market conditions and absence of such concepts in the market for consumers to see and visualise. In many ways, social challenges arise from lack of technology to educate consumers and lack of awareness to build the interest of consumers, firms and professionals in the sustainable value chain. Therefore, social issues have a moderating effect on the uptake of technology in construction, design and consumer engagement, and reflect in value propositions in the market at present. Thus, this relationship was marked (V) and denoted in cell 3-4.

11. Cell 3-5: Relationship between social and environmental challenges (V): According to focus group members, social challenges are key drivers in denial of importance placed on environmental issues. For example, lack of awareness about the environmental impacts of development and housing construction results in reduced consumer interest in addressing problems arising from effects of housing construction on the environment. Therefore, the lack of awareness among consumers and HCCs is given high importance in the discussion on SBM challenges. The focus group participants re-validated the importance of awareness among public and private stakeholders while emphasising the need to increase investment in environmental dimensions of SBM while seeking government and public support in such projects in a sort of PPP. This would help promote use of sustainable practices in future development and reduce overall consumption of electricity and water, thus saving the scarce natural resources of the country. As inputs from the participants concluded that social challenges are a driving force affecting mitigation on environmental challenges, its relationship is marked (V) and denoted in cell 3-5.
12. Cell 3-6: Relationship between social and legal challenges (X): According to focus group participants, lack of general awareness of sustainability is a major reason for

shortcomings in legal guidelines. The absence of a broad legal framework covering sustainable development stems from poor knowledge of the drivers of sustainability. According to FG2, *"educational and legal institutions barely give any importance to sustainability as a concept."* Therefore, legal guidelines are ambiguous and fail to drive SBM development. Also, legal restrictions on traditional methods of construction would help change consumer and business behaviours and attitudes, thus encouraging them to learn more about the benefits of SBM. Therefore, it is possible to establish a mutually dependent relationship between social and legal challenges, which is denoted as (X) in cell 3-6.

13. Cell 4-5: Relationship between technological and environmental challenges (X): The views expressed by focus group participants indicated a mutually dependent relationship between technological and environmental challenges. For example, FG1 said, *"… the country (means Saudi Arabia) is a harsh and arid country. We cannot leverage the environment at the cost of development. Our value creation must reflect in technology and design adoption driven by sustainability as the core guiding principle."* The above statement is crucial since environmental challenges limit the availability of natural resources. Likewise, unavailability of technology due to social, economic and political barriers increases environmental challenges, which could be mitigated if the required technology was made available. In this regard, FG2 said that, *"the key to improvement on the environmental side of development is to embed green technology in all processes."* On the contrary, technology innovation inadvertently creates an environmental impact as supporting infrastructure is built to perform research and development of innovative technologies. FG5 stated that, *"The importance of innovation in the technological factors gives rise to pollution and has an environmental impact."* Therefore, it is evident that technology innovation has an impact on the environment and the opposite is also true, as in the case of HCI. Therefore, the relationship between the two elements are marked (X) and denoted in cell 4-5.
14. Cell 4-6: The relationship between technological and legal challenges (A): The views of participants on this relationship placed legal issues as the driving force responsible for the slow adoption of technology, which poses a challenge in SVP creation and marketing. While their consensus downplayed technological challenges, FG4 stated that,

"application of new technologies in HCI that leads to an improvement in any of the elements of the SBM needs approval from a government body, such as the Ministry of Housing (MOH), Presidency of Meteorology and Environment (PME) or Ministry of Municipal and Rural Affairs (MOMRA). So, anything that is new or hasn't been heard by reviewers working for the ministry can easily be rejected on the grounds that it is new or lacks enough empirical evidence." Therefore, legal challenges and their redress will result in a systematic change and increase adoption of new technologies. The relationship between technological and legal challenges is thus marked (X) and denoted in cell 4-6.

15. Cell 5-6: Relationship between environmental and legal challenges (X): According to focus group participants, environmental and legal challenges are closely related and dependent on each other. For example, one of the participants highlighted the incorporation of a new legal framework that made construction in a harsh and arid climate feasible only with use of sustainable practices. Having such frameworks would serve to reduce overconsumption in energy and reduce the use of air-cooling equipment through design level changes. Therefore, having the right set of laws in place has a major impact on the trajectory of choices firms and consumers have while seeking housing solutions on the market. Likewise, environmental challenges, such as climate and topography, would have an impact on the type of development pursued in such areas and, therefore, drive relevant legal guidelines to the development of housing. Laws would need to take a selective approach in promoting the use of abundant renewable resources, such as solar, wind and tidal energy, over conventional resources, such as oil-generated electricity and water. Likewise, it would be necessary to tighten policy on imports of construction materials and encourage development using locally available materials, thus revolutionising the scrap and waste industry. Therefore, environmental and legal challenges are closely related and impact each other. This relationship is marked (X) and denoted in cell 5-6.

6.4.3 Developing a Reachability Matrix for SSIM

The Reachability Matrix (RM) is created by mapping the SSIM to a binary matrix form. For example, for a positive value of relationship among the denoted characters X, V, A and O, it is represented in 0s and 1s. The rules of substitution are as follows:

1. When entry character in the matrix (i,j) for any two challenges is ‘X’, the reachability matrix denotes it with a 1. Its corresponding entry in (j,i) is represented as 1 as per binary input classification.
2. When entry character in the matrix (i,j) for any two challenges is ‘V’, the reachability matrix denotes it with a 1. Its corresponding entry in (j,i) is represented as 0 as per binary input classification.
3. When entry character in the matrix (i,j) for any two challenges is ‘A’, the reachability matrix denotes it with a 0. Its corresponding entry in (j,i) is represented as 1 as per binary input classification.
4. When entry character in the matrix (i,j) for any two challenges is ‘O’, the reachability matrix denotes it with a 0. Its corresponding entry in (j,i) is represented as 0 as per binary input classification.

Based on the given rules, the RM for the challenges to the SBM is presented in table (6-17)

Table 6-17: Reachability Matrix

NO	Type of Challenges	1	2	3	4	5	6
1	Political	1	1	0	1	1	1
2	Economic	1	1	1	1	1	1
3	Social	1	1	1	1	1	1
4	Techno/Technical	0	1	0	1	0	0
5	Environmental	1	1	0	1	1	1
6	Legal	1	1	1	1	1	1

Table (6-17) presents the final RM for the challenges to the SBMs in the Saudi HCI. This table is used to calculate driver power and dependence, based on the binary values input from the RM. Table (6-18) shows the driving power of the challenges and those that can help researchers and professionals working in this field to tackle SBM development issues. Likewise, the dependence of each challenge on other challenges is also presented. Developing a strategy to tackle the issues under each challenge could bring an overall decrease in challenges faced by HCCs during the creation and implementation of the SBMs to help consumers to receive the SVPs promised. The challenges are classified into four clusters, based on driving power and dependence. These clusters are autonomous, dependent, linkage and independent or driving challenges. The classification and its implications are explained in detail in the next section.

Table 6-18: Final RM with Driving Power and Dependency for the SBM Challenges

NO	Type of Challenges	1	2	3	4	5	6	Driver Power
1	Political	1	1	0	1	1	1	5
2	Economic	1	1	1	1	1	1	6
3	Social	1	1	1	1	1	1	6
4	Tech/Technical	0	1	0	1	0	0	3
5	Environmental	1	1	0	1	1	1	5
6	Legal	1	1	1	1	1	1	6
Dependence		5	6	3	6	6	5	31/31

6.4.4 Classification of SBM Challenges – MICMAC Analysis

According to the total number of inputs for each challenge and its dependence on another set of challenges, they were divided into four clusters, as shown in figure (6-4) below:

Driver Power	6			3			2/6
	5					1	5
	4						
	3						4
	2						
	1						
		1	2	3	4	5	6
	Dependency						

Fig 6-3: MICMAC analysis diagram for SBMs challenges

The findings of the classification are given below:

1. No challenges belong to the autonomous cluster. According to the MICMAC analysis, elements placed under autonomous cluster appear as weak drivers of a phenomenon. Likewise, they are weakly dependent and stay relatively disconnected from the model in question. Also, such elements or challenges have a low rate of significance and influence on other factors in the model.
2. The group of challenges reported under technological domain, for example 'lack of information', 'low level of practices', 'lack of sustainable value chain', and 'ICT building capacity' was found to have a weak driving force in the model. However, it exhibited strong dependence on other challenges in the SBM; thus, technological challenges are classified as dependent challenges. Therefore, elimination of technological challenges requires alleviation of dependence factors.
3. Linkage factors, such as political, economic, environmental and legal challenges, show a high level of driving force behind other challenges in the model. They also have a high level of dependence on technological and social challenges. However, the challenges in this cluster are unstable, such that transformations in one of the challenges would introduce a new set of impacts on the elements it is driving. Likewise, changes in any one of the challenges would create a feedback loop, thus leading to ripple effect in terms of change in the challenge itself. Therefore, the third cluster contains the maximum number of challenges. It has a high level of driving influence and dependence power. Challenges listed in this cluster are highly unstable. Any form of influence on the challenges will impact challenges outside this cluster. Therefore, this cluster is an important domain for professionals in the Saudi HCI. Some of the key terminology in expressing the challenges in this cluster are 'lack of legal framework', 'Saudi Building Code (SBC)', 'lack of clear policy', 'lack of management commitment', 'limited financial incentive', 'low demand', 'low energy cost', 'shortage of natural resources', 'not included in procurement and public contracts', and 'high waste industry'. The combination of these challenges classified under political, economic, environmental and legal have the highest effect as a group, thus making these challenges the focal point for study and for implementation of SBMs.

4. The last cluster, having a strong driving power and a weak dependence power, is social challenges. The ideas behind social challenges are mainly independent of factors linked to the remaining challenges identified in SSIM. Taking notice of factors in the social dimension and addressing them first would create a significant number of changes in political, economic, environmental and legal issues associated with SBM. Therefore, it is possible that alleviating social challenges can directly or indirectly remove some or all of the challenges in the remaining categories. This cluster contains key issues, such as 'lack of awareness' among consumers, HCCs, government and professionals working in the housing construction industry. Also, factors such as 'acceptance of sustainable technologies' and the view that 'sustainable development costs more' are noticed. Therefore, increasing the level of acceptance among them in viewing housing as a creator of sustainable value rather than as an economic model of wealth generation will help forward the SBMs view among HCCs and local government institutions.

6.4.5 Partitioning the RM into different levels

Based on the final RM, the set containing the reachability for each barrier is derived and the intersection of these sets identified. This is shown in table (6-19). The first iteration gives precedence to the challenges whose reachability and intersection sets are the same and assigned the highest priority level in the ISM. Similarly, elements contained in second and third levels are identified by duplication of the process used in the first iteration. When a level has identified a challenge and placed it in the model, it is removed from the set of challenges. In the first iteration, challenges comprising economic, technological and environmental issues are found. They are represented in table (6-20) and removed as inputs to the second iteration. In the second iteration, political and legal challenges are identified, as represented in table (6-21). Social challenges are found at the third level of iteration and shown respectively. Every iteration segments the list of challenges into a hierarchy consisting of distinct levels. Each level has significance in the ISM, which is discussed in the final step of this section.

Table 6-19: Iteration 1

No.	SBM Challenges Type	Reachability Set	Antecedent Set Intersect	Intersection Set	Level
1	Political	1.2.4.5.6	1.2.3.5.6	1.2.5.6	
2	Economic	1.2.3.4.5.6	1.2.3.4.5.6	1.2.3.4.5.6	1
3	Social	1.2.3.4.5.6	2.3.6	2.3.6	
4	Techno/Technical	2.4.5	1.2.3.4.5.6	2.4.5	1
5	Environmental	1.2.4.5.6	1.2.3.4.5.6	1.2.4.5.6	1
6	Legal	1.2.3.4.5.6	1.2.3.5.6	1.2.3.5.6	

z

Table 6-20: Iteration 2

No	SBM Challenges Type	Reachability Set	Antecedent Set Intersect	Intersection Set	Level
1	Political	1.6	1.3.6	1.6	2
3	Social	1.3.6	3.6	3.6	
6	Legal	1.3.6	1.3.6	1.3.6	2

Table 6-21: Iteration 3

No	SBM Challenges Type	Reachability Set	Antecedent Set Intersect	Intersection Set	Level
3	Social	3	3	3	3

6.4.6 Developing the ISM model for the SBM challenges

The segmented view of the challenges has a meaningful impact on the overall understanding of the adoption issues facing SBMs in the HCI. At the lower levels are economic, environmental and technological challenges and difficulties that hinder implementation of SBMs view in HCCs and creating an overall positive environment supporting views of sustainability. In the economic segment, ‘limited initiatives’, ‘high up front’ and ‘low demand’ for the SBMs are factors leading to its slow uptake in the HCI. Besides economic issues faced by HCCs, environmental challenges, such as ‘shortage of natural resources’ and ‘high waste industry’ for the SBM are reported. Technological constraints such as ‘low levels of ICT adoption’ and ‘low innovation capabilities’ in the construction sector are reported by participants of focus groups. Economic, environmental and technological issues are categorised as problems existing in silos and have a low rate of influence over each other.

For example, massive improvements in renewable technologies or waste reuse management and processing facilities would still have a low impact on environmental or economic challenges compared with removal of social challenges combined with renewable-friendly policymaking and incentive-based licensing of waste processing businesses. Therefore, economic, environmental and technological challenges are placed at the top in the first iteration of the final ISM challenges.

The second iteration places political and legal challenges as the next highest level of priority based on inputs by focus groups. Key themes emerged during the discussion, for example, ‘absence of legal framework for sustainable construction’, ‘lack of collaboration between stakeholders’, ‘unclear building code’, and ‘lack of inclusion in procurements arrangement’, which works as a safety net for financial losses. Likewise, political challenges emerged in the form of ‘political commitment and will of leadership’ as the next big issue. Provided that political leaders have fulfilled their commitments, as made in international forums and multilateral meetings, there would be less need to push for the sustainability agenda from within the country. The third and highest level of importance is given to social challenges. This is due to the public’s inhibitions relating to the quality and performance of the SBM, as well as high upfront costs. The lack of visible examples and long-standing records of SBMs as live examples often create negativity and fear among consumers who are afraid of investing in SBMs. However, such issues can be removed when consumers become aware of sustainability benefits and are educated, not just as an economic and social investment, but also as a step towards helping the environment and improving the planet by making the right choices. Therefore, themes such as ‘lack of awareness’ are key drivers for the slow uptake of sustainability in HCI by professionals working in Saudi HCCs, financing firms, and local and political leaders, as they are unaware of the long-term benefits. Figure (6-5) shows the hierarchy and positioning of each challenge and its relationship with other members of the group.

The final ISM model is shown below. The arrows and their directions show the nature of the relationship between two challenges; such as whether any two challenges are mutually dependent or independent. For example, the relationship between economic and environmental challenges is dependent on interactions between both entities. The relationship between political and technological challenges is one-way and across different levels of hierarchy, as represented in the final set of challenges in ISM.

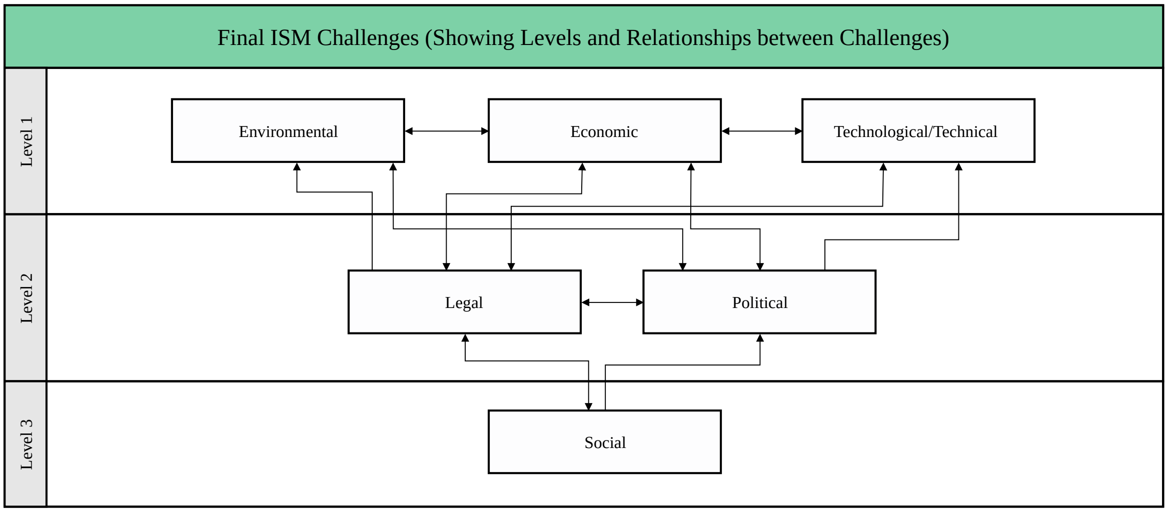

Fig 6-4: ISM - based model for the SBM challenges

The observations made from figure (6-5) position social challenges as a significant factor influencing other key factors, such as legal and political challenges. Therefore, its alleviation is of prime significance in relation to adoption of SBMs among firms in the Saudi HCI. However, issues emerging at the first level under the economic, environmental and technological group of challenges have a definitive role in the delivery of the SBMs. As such, addressing high waste issues and consistency in delivering clean energy at an affordable rate over a long period of time is a complex managerial problem. However, issues relating to the effectiveness of value delivery and capture are resolvable once these challenges have been removed and the SBMs framework is used for value creation, delivery and capture.

6.4.7 Discussion

Top management and industry professionals, managers and policymakers are likely to face obstacles while trying to achieve SBM transformation in the HCI of Saudi Arabia due to the challenges identified and classified in this study. The emerging challenges have been classified and arranged into an ISM for analysis and are further listed in the form of the PESTEL framework. Therefore, the challenges mentioned above should be addressed to achieve success in creating and operating HCCs under a SBM. The ISM used in this study has a realistic and strategic approach to management of the problems identified in the HCI, thus enabling a smooth procedural flow towards sustainability. Previously, several studies have explored and documented multiple challenges that hinder firms from transforming and achieving sustainability in the Saudi HCI, but not inclusively SBMs. However, the present study combines findings of previous studies, such as challenges to SHPs, and examines co-dependence between those challenges, which has not been performed in literature before now (Abdellatif, 2006; Al-Jamea, 2014; Al-Shaalan et al., 2014; Alrashed & Asif, 2012; Asif, 2016; Dipaola, 2016; 'Future Saudi Cities,' 2016; Landreneau, 2012; Mosly, 2015; A. Surf & Saied, 2014; Mohammed S. Al Surf & Mostafa, 2017; Mohammed Saied Al Surf, 2013; Taleb, 2011; Xue, 2013). This study is unique from the perspective of identification of challenges associated with SBMs implementation in the HCI and in recognising interaction between challenges to SBMs transformation and their co-dependence, which are novel contributions to the literature. ISM creates a positive approach and a different perspective by viewing challenges to SBMs as opportunities for investment instead of the limiting nature of financial incentives for seeking sustainable development in the future. Observations developed using the ISM and driver-dependence diagram, which allow further examination based on management experience and understanding of the relationships, are given below:

The extent of social challenges, such as lack of awareness, knowledge and perception of sustainability as a costly service for both stakeholders and consumers has been identified. This is a significant group of issues that is placed at the base of the ISM model as it leads to other challenges due to its high driving power. The set of social challenges contributes to the development of a cycle of general unawareness and inhibition relating to the benefits of sustainability practices and SBM transformation in the HCI. Therefore, stakeholders are either uninterested or have a negative view about SBM development and practice; for example, use of sustainable construction materials, design and engagement of end-users in partnerships that extend over the project lifecycle. Consumer choice plays a vital role in sustainable value-driven outcomes. High consumer demand could transform the business processes of the HCI and government institutions, which could work together to deliver sustainable value. This would enable consumers to feel satisfied with the end result and mobilise their active participation in the development of the product. Challenges in the social category are highly influential as government officials and top management professionals could otherwise fail to give due importance to sustainable practices which, in turn, could encourage the HCI to adopt the SBM as a viable factor of production. To create a healthy environment for SBM transformation, firms must begin by educating their employees about sustainability as a value-creator. Likewise, firms can work independently or in collaboration with partners to reach consumers, including all TCs, making them aware of the benefits of sustainable housing, modern methods of construction, materials reuse benefits, renewable energy investment benefits, and develop an overall risk portfolio of housing using traditional methods versus sustainable building lifecycles. The adaptation of SHPs can include the support extended by the local government as per local laws and regulations, which cover natural risks to the consumer. Therefore, the overall objective in working towards the alleviation of social challenges is to target people at all levels of economic classifications, job profiles and social structures to create awareness of sustainable development in housing as this awareness will create new demands, and barriers to policies and laws will disappear gradually due to social transformations.

The next set of challenges, which require a careful approach towards their mitigation, includes legal and political challenges. As per ISM, they have a high level of dependence and driving power. Efforts are required, according to the views of participants, to strengthen the coordinating functions of Presidency of Meteorology and Environment (PME) so that it enhances the overall insights of the concerned local institutions and promotes the implementation of all the necessary environmental regulations. Henceforth, the Saudi government should provide a transparent mechanism to assess housing firms so that they are classified according to the type of project they undertake. Each project should be documented by the government and given an overall rating according to the type of construction practices being employed. Firms that engage in unsustainable development could be charged a development tax, which could be used to support funding of sustainable projects. Likewise, the government could establish a monitoring agency that would report on firms that evade tax and use less sustainable construction methods. This would create a sense of concern among firms that try to exploit consumers with the promise of low-cost housing or engage in corrupt practices. Similarly, the SBC should be enacted with greater vigour and improved periodically to reduce the number of building violations and also the number of legal hurdles faced by firms seeking sustainable construction or compensation from the government. Sustainability standards are necessary for all buildings and thus require a model that checks and awards firms that fulfil the guidelines. Therefore, a combined effort by the government and legal institutions encouraging and rewarding sustainability in construction would motivate the public and private sectors to comply with SBMs. However, to realise such benefits, HCCs would need to replace their BMs with SBMs as creators, drivers and aggregators of value generated over a period of time.

The last in the set of priorities for tackling traditional methods of construction and problems in the HCI at present are economic, technological and environmental challenges. They are placed last in the ISM classification because they are largely independent challenges that must addressed with unique approaches. Challenges listed above, such as social, political and legal, need to be addressed first before targeting removal of economic, technological and environmental challenges. The discussion demonstrates that the prime beneficiaries of economic, technological and environmental benefits are both stakeholders and consumers. However, to bring these benefits to consumers, social awareness combined with political and legal recourse must be made available at the necessary junctions. Another finding from this study is that economic, technological and environmental challenges are interrelated. Environmental benefits are easier to achieve when technological innovation is funded and guided holistically. Availability of information enabled by ICT will allow investors to take interest in the SBM as it would be supported by a strong business case. Limitations in financial support from investors could fail in value delivery functions or performance of sustainable solutions leading to a mismatch between a set of expectations and outcomes in a SVP end-product. Lack of financial support would also cause high wastage of resources surrounding the built environment. Therefore, political and legal challenges emerge as an incentivising factor for reducing economic, technological and environmental challenges. For example, removal of fuel subsidies and channelling the earnings towards sustainable activities, such as import of technologies and improving performance of environmental impact assessment agencies at local levels, is achievable. Firms should have the resources available to feed excess energy generated on-site back to the local grid for use in another location. Waste materials generated should be collected and used in another project thus reducing the burden on landfills. This approach would enable the creation of recyclable resources and products due to the timely intervention of the government and establishment of multiple recycling facilities in urban cities. Designers and engineers in HCCs must be given training on sustainable designs that produce SVP in order to develop their capacity to undertake bigger projects. Therefore, challenges to successful implementation of SBMs in the HCI are interrelated, but they can be addressed if the government creates a positive environment in relation to sustainability and takes corrective action, moving the consensus towards sustainable practices. This approach may have short-term consequences leading to a slowdown in the growth rate of the economy during the period of transformation. However, it is possible to eliminate the negative effects by taking a decisive approach to SBMs as the only way forward for all future projects in the country. New laws at a local level on sustainability and assessment methods could be developed to achieve SBMs among all firms in the HCI in the country.

In summary, social factors have a very significant and influential role in the challenges that emerge in SBM adoption. These challenges have gathered the highest consensus among industry professionals. Social challenges lead to the occurrence of many other challenges, such as the view that sustainability costs more. Such problems in consumers' minds lead to low overall demand. In some examples, SBMs were found to cost more in the initial phase driven largely by the cost of innovation of technologies. This has led to the misconception that SBMs cost more than traditional BMs development. While this additional upfront cost in SBMs is present due to investment in, for example, renewable technologies, design and methods of construction, a low operational and maintenance cost will offset and resolve such issues during the project lifecycle. Likewise, when SBMs take precedence over traditional BMs in the market, economies of scale will reduce the burden of upfront costs for consumers and financial partners of TCs in the housing project. Another perceived issue, noted by industry professionals, relating to sustainable construction materials is that they are of low value and quality. Such views emerge from lack of both credible knowledge and working examples in communities, owing to limited availability of sustainable construction materials and high costs associated with low demand. Therefore, it is crucial for the Saudi Government and stakeholders of sustainable development to prioritise education on the long-term benefits of SBMs, which are reasonable, smart and save costs during use. These benefits will attract consumers when they are combined with economic benefits and community development opportunities. In summary, the HCI has slowly yet steadily moved towards green transformation, and sustainable development and using SBMs is the next logical step. Thus, identification of issues, problems and challenges influencing HCCs' decisions relating to adoption of SBMs of great importance. The findings presented here will support decisions on housing and construction processes and help top management to prioritise activities that proactively mitigate and resolve these challenges.

6.5 Practical Guideline for Managers

Given that the challenges in the HCI would be systematically lowered until they are eliminated, it is essential for business leaders and top management professionals to create a path to guide managers on ways to implement SPs and processes to implement the SBMs concept and create SVPs for TCs. Although there are some works on the conceptualisations of BMs and the design of SBMs frameworks, there is a lack of works on SBMs application guideline. In fact, relevant research on SBMs framework guideline in the HCI that can be used for further exploration could not be found in literature. The guideline proposed during this stage has been developed from the empirical findings from Chapter 5 and 6 indicated that the resulting guideline of this research could be used as another layer of support to help HCCs to improve BMs activities towards solving the industrial problem and change toward sustainable future. The guideline questions were prepared prior to conducting the focus group with the experts. The questions below were presented to the participants and customised to capture expert opinions on the phenomenon. During the focus group, the researcher asked the questions and at the same time allowed discussions and development of any further issues that they felt relevant. The responses are conceptualised, as shown in figure (6-6), as this provides a hierarchical structure to the processes and arranges all the elements required during the implementation phase for the SBM concept. Thus, the figure serves the purpose of answering the following questions for managers engaged in the housing construction industry:

- How can managers introduce changes in their BMs to transform them into SBMs?
- How can a set of priorities be created from the list of tasks that should be implemented for improvement in areas specific to the HCI?

The SBM framework developed in this study provides answers to the two questions above. The implementation of the SBMs typically begins with analysis of the existing situation, as shown in figure (6-6). This task will help managers build a case for the transformation and identify areas that require attention as per the model. The changes identified during this activity should reflect the organisational aspects that create a need to redesign certain processes or reconsider in some cases. However, if business processes differ completely from existing market needs and overall situations, a change or complete rebuild of the BM is necessary to simulate the SBM approach.

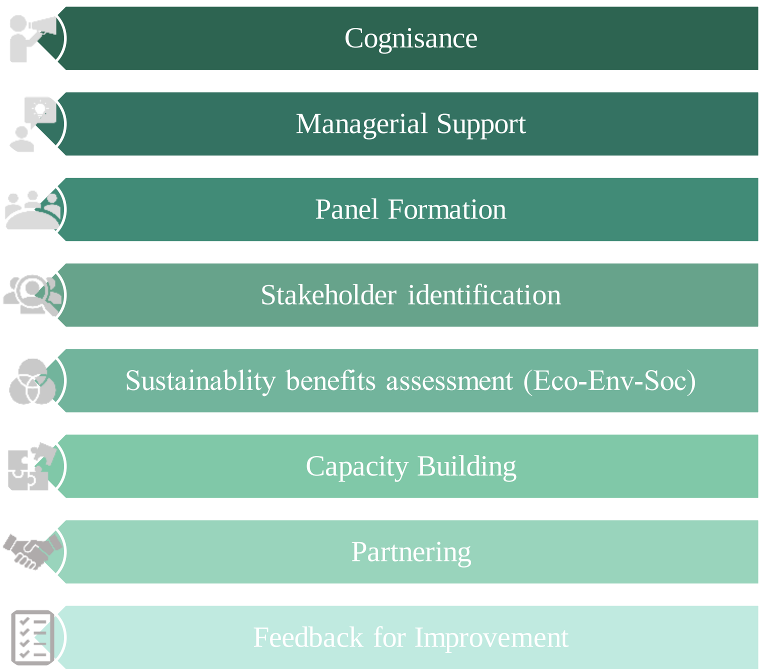

Fig 6-5: A guideline for SBMs framework implementation

- **Cognisance**

Organisational change is a desired quality in modern firms. The dynamic nature of competition in business often leads firms to evolve rapidly. Some firms have developed a structure that allows them to adapt to changing needs of customers with greater ease than other companies. For example, companies in online e-commerce business can actively change the look of their websites, product categories, classification and personalisation algorithms to suit and serve customers better than brick-and-mortar establishments selling the same products. Likewise, firms that can align and maintain their business processes at a faster rate than competitors in areas such as identification of TCs, capturing their needs correctly and developing SVPs that are attractive, will have a sustainable competitive advantage in the HCI. However, for change to happen, it must be driven from top management as a culture, so that the whole firm is ready to accept change. Organisational-level changes are often affected by uncertainties, which cause employees to try to hinder processes associated with change. However, firm owners and senior management should create a sense of urgency around the need to change, as this would inevitably lead to losing out to the competition. Firms can encourage ideas from within the organisation and reward employees who lead the change and openly give support. Incentives would encourage suggestions from employees on how the firm can improve its understanding and awareness of the market and create TC segments based on the spark from the senior management to get the change process started in accordance with the SBM concept.

To implement SBMs in the HCI, factors such as low demand due to low awareness and ambiguity about the long-term benefits must be tackled carefully. Given that such factors will be alleviated slowly as the market starts to recognise the SBMs, HCCs would need to use creativity in serving markets with low demand initially and also have a model that successfully supports value creation, delivery and capture. Such strategies can combine with programs supported by firms and its partners as the first phase of consumer segmenting and removing consumer doubts, while also capturing their needs to develop SVPs for each customer or segment. For example, programs could include sessions of doubts that compare prices, quality, comfort and lifespan and side-by-side comparison of traditional BM housing outcomes compared with SBM outcomes. However, such projected models should be carefully developed, taking all elements of the SBM into consideration. The sales workforce could create CRs and engage customers on online and offline channels, according to their preferred channel of communication. Therefore, workshops and skill training of workers should have a bearing on improving workforce behaviours and attitudes to SBM promised value. Improving confidence levels of the sales workforce will reflect in their attitudes to the SBM and improve customer relationships.

Customer's level of understanding and awareness of SBM outcomes would develop through a series of interactions, which may take time, while the customer experiences a gradual change in behaviour. HCCs should consider potential threats and uncertainties as they develop SVPs for TCs. They would require technological support to develop scenarios showing projections for the future. This is combined with available opportunities that HCCs can use to create and deliver value. An honest discussion with consumer and sharing thoughts and ideas about issues they encounter in striving to achieve their goals from housing will result in a dynamic perspective and convince people looking for housing. HCCs can seek support from customers, partners and industry people to strengthen their arguments and make such discussions interactive.

- **Managerial Support**

Among the objectives of SBM is creation of a clear understanding of the way firms create, deliver and capture promised value. This is possible when managers receive the necessary support in the form of guidance, commitment and passion from top management through executive functions. Facilitation of resources for managers to achieve their goals is one of the duties of realisation for the top management. Managers would require knowledge of current market practices, prices of materials, available inventory and cost structure of resources to determine whether they can provide value to the customer at competitive prices or whether firms will need to partner to collectively pool resources for value creation. Therefore, drawing a SBM will help managers understand the process and communicate areas where they need support and guidance from top management. These activities will allow managers to see the opportunities in the process of transformation from old practices to the SBM. It would enhance process quality, and improvement in communications would reduce time required to deliver SVPs.

This phase is a priority area for bridging HCCs' activities with partners and resource estimations for any project. Such tasks require a high level of acceptance from management and commitment. Therefore, senior management should make managers responsible for creating a strong understanding of the BM of the company and highlighting areas where the firm could exchange unsustainable practices for improved methods of development without affecting their CS or RM. Over a period of time, managers and senior management would develop a comfort level that allows smooth flow of support for certain processes, thus allowing managers to be productive and focus on increasing value for the HCC, customer segments, HCC's partners and an entirely new value chain.

Support for change will be driven by management while providing avenues for managers to be creative. Increased participation and interaction among staff are a likely by-product of SBM design. Senior management would also increase its level of interaction and communication with staff and create a vision of change that navigates their HCCs towards SBMs. It will be important for the HCC to send a clear message, as any form of ambiguity in the direction of the firm and where it is heading will result in internal failures. Therefore, leadership plays a role in promoting SBM in the HCI and among its partnering organisations by including, sharing and devising strategies. HCCs can make combined efforts to formulate policies and submit them to local government agencies for their consideration.

Business executives may have to develop a language that supports the sustainable transformation at its core and drives it as a strategy in all business decisions. Management will need to remain patient and encourage its teams to believe in the vision of the company as their confidence in the sustainable movement will be the deciding factor in steering the firm through new markets to create a niche for themselves. Some of the key concepts where top management must be precise are consistency and clarity in communication, setting reasonable expectations, provisioning adequate support for achieving the goals and motivation of managers and all stakeholders engaged in this activity. The HCC's level of success in creating SVPs depends on how well senior management can guide managers and staff towards a vision of sustainability.

- **Panel Formation**

After developing a strategic vision and thinking in the organisation and having identified the areas for improvement, the directing or implementing teams must match ideas with available resources to create plans. Apart from monitoring execution of the plans proposed for development, managers should keep a close track of the execution of proposed plans and suggest any new areas of improvement after conducting a reassessment of the existing plan with suggested new changes. It is necessary to create a map of activities showing tasks to be accomplished. For example, to develop a three-dimensional structure of the site, houses and renewable energy units, office spaces and recreational areas, and waste management systems as part of the design task. The number and scale of designs should be modifiable and self-adjusting (flexible) to changes in a single module. For example, software for Computer Aided Design (CAD) and Building Information Modelling (BIM) should automatically adjust land measurement variables and notify designers when measurements for a certain object (e.g. energy storage units) are increased or decreased. This will allow the design team to take note of the changes in real-time and require less effort. Likewise, it would be easier to inform the management. For example, increased energy storage unit space by ‘x’ square meters, decreased recreation space area by ‘y’ and average area of Class B residential units by ‘z’ square meters. Such a model will increase the implementation model.

Every activity in a traditional BM must have recommendations from the manager with a risk-benefit analysis of the activity and possible alternative mechanisms, costs and methods of acquisition. In simple terms, a detailed review of every business activity that will be undertaken as part of the VCs in the SBMs plan should be presented in front of a panel consisting of members from top management, sustainability experts and members of the partnering firms, if necessary. The team of experts and managers can use their creative skills to provide detailed solutions to sustainability problems. A formal report of the plans should be combined with informal discussions with key members, including designers, managers, experts and top management for collective decisions to be made. The importance of the team of experts in sustainable design and planning is paramount as their experience will guide possible sustainable alternatives that are easier to implement and will enable the HCC to establish itself in the HCI in a competitive way. Such members would also allow HCCs to manage the process of change effectively and reduce resistance from staff while empowering them to become active participants in the change process. Experts would be required to develop successful and efficient plans that provide professional benefits for the HCC, improve quality of process delivery and increase interpersonal relationships among employees and leaders throughout the process of change in the organisation. The panel of advisors can create recommendations for employees to review plans presented by the advisors and conduct a thorough analysis of alternative methods to consider ways in which they could be integrated and the areas that would be affected. Therefore, multiple SBMs would take shape as a result of empanelment of sustainability experts, industry professionals and top leadership. The richness of this platform would enable managers, staff and employees to grow and share the language of the business model in their activities as well as the transformational process of converting the BM into a model that has sustainable alternatives mapped during the entire project lifecycle.

- **Stakeholder identification**

HCCs are often unable to identify every stakeholder in the process of development in a SBM for a housing and construction project. While the key stakeholders, such as TCs, financing agencies, contractors and suppliers, maintain close communication due to their levels of participation in the VCs, distant stakeholders, who may also benefit from the development of the SBMs, are left unattended. For example, working in the HCI in a SP that serves as an ecological habitat for vulnerable species endemic to a region should attract the interest and engagement of local government and non-profit environmental protection agencies as supporters, financers and key members of an advisory team during SBM development and design of SVPs for TCs. In another example, distant development projects must view the SBM as a complete set of solutions for TCs. As such, a development site with residential housing, schools, parks and offices must also provide leased out spaces for firms setting up offices in such locations and for staff who wish to live there temporarily. Therefore, identification of this requirement and development of such a model would secure long-term revenue, based on the needs of businesses establishing offices there.

Identification of stakeholders requires planning, creation and capture of opportunities while, at the same time, acknowledging the people, HCCs or organisations benefitting from this service directly or indirectly. Thus, every stakeholder can be mapped to a value that it would receive from a set of tasks performed by HCCs. The level of involvement, communication, impact and benefits can be factors of their hierarchical segregation. So, every stakeholder, whether having a small or a large stake in the development, should be identified. The SBM enables HCC to reach agreement with stakeholders about benefits arising from a development. Thus, identification and prioritisation of needs and requirements of stakeholders is a crucial activity and supports value creation for all existing and future stakeholders. The HCC's approach will define its management qualities and even allow it to reduce the burden by pairing stakeholders with matching requirements. For example, a company with experience of off-site construction could be paired with a composite material manufacturing company to see if they can make high-quality construction blocks using renewable materials, or use reverse engineering methods to develop construction blocks or slabs that can be used for construction while passing all engineering and structural quality checks.

In summary, stakeholder identification is a management activity that recognises the potential of engaging people from different areas in a common activity. This may help achieve the firm's end goals or contribute to the fulfilment of intermediate goals. The HCC would be responsible for balancing economic, social and environmental values by encouraging mutually beneficial relationships between pairs of stakeholders. It would be necessary to engage in regular communication throughout the process of value creation with stakeholders identified at each stage of the project lifecycle.

- **Sustainability benefits assessment (Eco-Env-Soc)**

As stakeholders and the extent and level of their involvement in the SBM VCs are identified, the LCCA will contribute to the understanding of the project feasibility. The SBM will highlight factors that impact the social and environmental dimensions of the development. For each cost incurred during the project lifecycle, such as renovation, renewable energy-related investment, or land space allocation for social and community building activities, its corresponding benefit should be mapped; for example, increased customer satisfaction, increased revenue from social improvement-related investment, and so on. Benefit assessment can be described in terms of lower energy costs and reduced number of complaints and defects during project management. Therefore, any cost incurred in the VCs of SMB development is linked to an increase in economic, social and environmental benefits. During the analysis, the SBM is presented as an agenda that encompasses all factors of production and delivers value with the lowest economic, social and environmental impact for all of the stakeholders.

- **Capacity Building**

HCCs would have to ask themselves whether they are ready to begin the process of transformation. However, this must be preceded by the positioning of changes that support and guide the process of change in the organisation. Managers should be capable of identifying differences between traditional and SBMs and show the same using data, numbers and figures. When viewing a business development process through the three dimensions of sustainability, existing capabilities would cost more for HCCs over the project lifecycle. This would promote the cause for changing organisational capabilities and bringing in processes and infrastructure that supports sustainable development activities. Over time, the cost of such new investments will be offset by the revenue from sustainable development projects. HCCs that recognise the direction and pattern of local, national and global shifts in terms of energy creation, development, logistics and organisational principles will take the lead when markets reach a point of saturation from unconventional practices.

New VCs would depend on the acquired KRs by the HCCs and its PNs. Creation of new KRs are crucial for HCCs to think in terms of SVPs. Market behaviour guided by existential factors will automatically guide consumers to benefit from new VCs provided by SBM-oriented HCCs. They can either choose to acquire all major KRs to provide SBMs and SVPs without utilising PNs, or choose selective partners where investments are higher and impact on the final value is minimal. Therefore, a balance of costs with final value is crucial for HCCs to establish a path that helps them navigate value creation, delivery and capture process. Creation of a blueprint is necessary and essential for visualising the VCs and KRs needed to acquire or outsource. This ensures a balance in the revenue logic and allows them to move ahead strategically with the selection of partners that could be needed during the project lifecycle.

- **Partnering**

HCCs with similar vision and BMs in the value chain, providing service areas, products and target markets, must work in collaboration to create a greater impact than when they undertake that same effort individually. This includes the commitment of top management, political leaders, teams of sustainability experts working in highly influential positions in the industry, large scale suppliers of green materials, and even business leaders looking to adopt SBM solutions for their own firms. The formation of powerful partnerships along the value chain will create a high level of dependence between all the firms involved. Therefore, the success of one partner in the link of stakeholders will lead to an equivalent increase in benefits for other members who have joined as partners. A commitment to sustainability implementation will provide the motivational factor, develop trust and financial dependence among partners, enabling them to increase their collaborative efforts as the success of one member is linked with the success of another member, firm, group or individual.

Establishing a new and sustainable value chain often requires long-term partnering capability. This is one of the strengths of the SBM, as it leverages the solutions available from the firms' internal KRs and VCs as well as from their PNs to create SVPs that other firms cannot provide for the same TCs. Similarly, customers are important members in this value chain. They will become important contributors to the value creation through their engagement and collaboration in activities. For example, people buying homes may work in offices and create value for the employer. To improve their lifestyles, consumers then spend their earnings on products and services from another firm; thus, the value created in one cycle will drive another financial cycle. It is necessary for HCCs to identify opportunities that allow them to enter the value creation, delivery and capture process.

- **Feedback for Improvement**

All stages of SBMs design and alignment of processes that transform existing BMs must have opportunities to capture feedback for improvement in the current or next project. Mistakes in the assessment of market trends, lack of awareness of top management about sustainability principles and weak partnerships are likely during the initial stages of SBMs. However, continuous improvement in project management and ability to learn from feedback and adapt while staying flexible, absorbing changes, capturing new information and processing that information will be the key to successful planning and implementation in projects. The key activities proposed in the blueprint must be followed and new activities and learning should be reserved for incorporation in the next project cycle. In case a project is adversely affected by a planned process that does not work out as anticipated, managers can follow the SBM guidelines, as provided in the steps, to identify alternative sustainable methods, which the top management can then decide upon, along with a panel of experts and stakeholders. At this point, management should keep track of the events that failed in the project delivery processes and try to avoid them during value creation activities in future projects.

6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8
Introduction	Focus Group Profile	ISM Modelling SBM Implementation Framework	ISM for SBM Challenges	Practical Guidelines for Managers	Validation	Recommendations	Summary

6.6 Validation of the ISM-based model for the SBM elements

Participants in the focus group were consulted after analyses and development of the ISM model. This was to consider and validate the final design of the ISM. The validation process constituted review of the ISM and determining whether the focus group accepted the ISM model or suggest further changes. Therefore, validation is a requirement of research that lets participants in the study validate the data gathered and confirm that methods applied in the data have been justified. Validation strengthened the relationships between elements and confirmed their usefulness in this study. The validation process helped discover any missing information in the model and found ways to further improvement. The findings during validation of the study are arranged into three broad themes: SBM elements, relationships between elements and practical guidelines to SBMs.

6.6.1 SBM elements and their relationships

The ISM-based model had a six-level architecture with the foundation level, serving as the driving force. The participants reached agreement on the organisation of elements and development of the complete model in the context of the Saudi HCI. They felt that HCCs should begin their activities at level 6 and move towards lower levels to increase clarity. Some participants, for example, FG2 and FG3, suggested use of different terminology, like ‘value offering’ ‘value creation’, ‘value capture’, value delivery’, as such terms are used quite extensively in BM literature. Likewise, these terms are also used in this study in Chapter 3, repeatedly, to define value as a concept in the HCI. According to FG1:

"It's a credible design, the elements are strongly connected and have high relevance and impact on each other. This might work! A model should be strongly connected. The hierarchy follows the way information should flow in and out of the model; that is, from a higher level to a lower level".

The blueprint of the SBM design was recognised as a simple and effective approach to combine largely unrelated elements into a model and to promote system-based thinking on the concept. A clear understanding and knowledge of each element was considered important for the transformation of BM into SBM. The benefit of using focus groups as a method for developing the ISM-based SBM was that it highlighted the industry-based views as deemed relevant in the HCI and found the drivers of SBM using experts in the field. For example, FG1 and FG3 reported the increasingly crucial role of the consumer in the value creation process. Although they found that customers shared equal priority in the value delivery and capture stages with other stakeholders, such as the HCC and its PNs, but the TC had a significant role in the value creation phase. Development of SVPs was another important part of the SBM. The strength in this model stems from the value creation and capture mechanisms that drive sustainability to the overall model by placing customers' needs, and therefore their roles, at the centre of the model. The final version of the ISM-based model for the SBM elements, according to value-based design, is shown in figure (6-7) below.

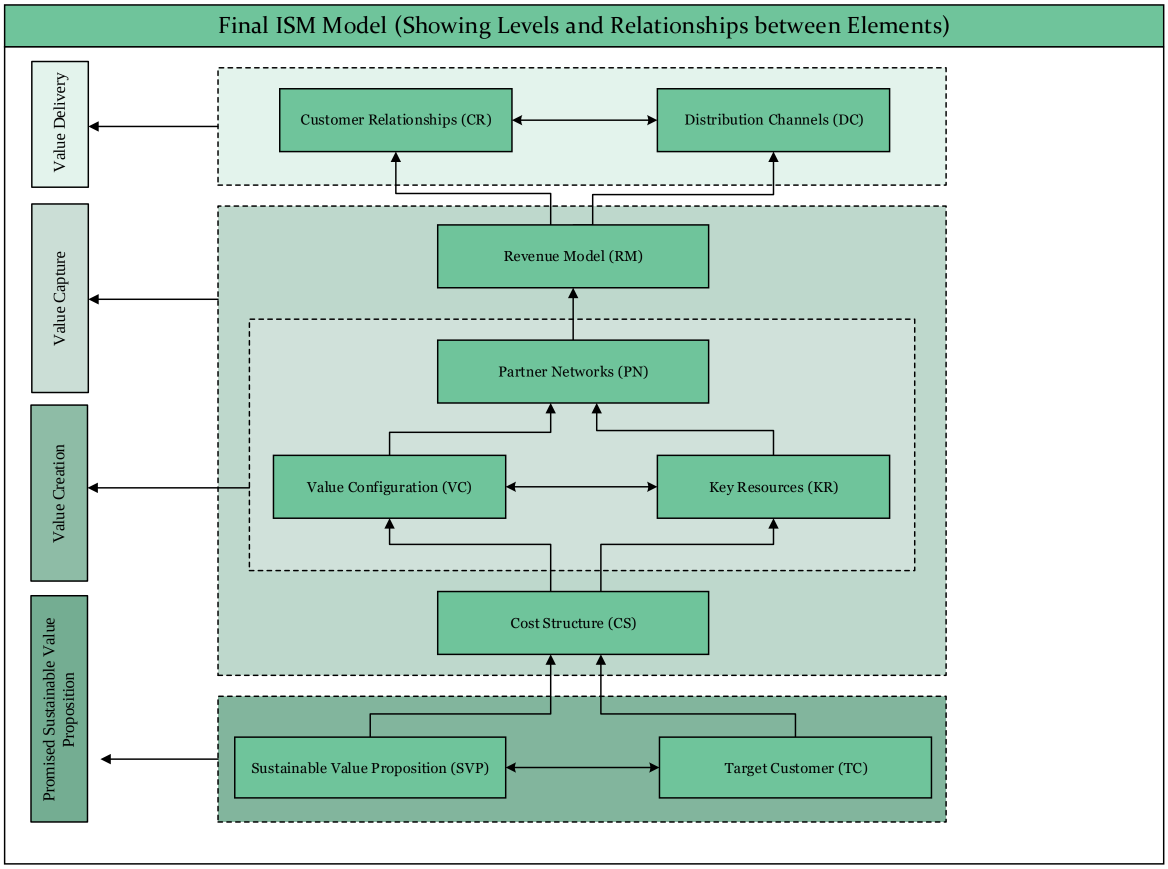

Fig 6-6: The final version of ISM-based model for the SBMs

The figure shows the final model using the ISM for SBM and including all the elements that would be required for promised value creation, delivery and capture. As per the model, elements such as VCs and KRs comprise the value creation process. Similarly, SVP and TC elements are promised value capturing mechanisms or receivers of the value generated. Value creation and value delivery require a background in environmental and financial logic that caters to the organisation of activities, described as RM.

In the process of SVP design, the role of partnerships or HCCs' VCs and KRs were given credible weightage as the necessary drivers of sustainable value. All elements had a defined role in the working of the SBM and it was difficult for focus group members to reach a conclusion on the necessity for removing or adding another element to improve the SBMs' performance at the organisational level. According to FG5, *"This model represents an accurate representation of how I think a developer should move ahead to achieve sustainability."* Similarly, FG4 said that, *"In recent years, HCCs have faced immense* *challenges which caused failures and losses because they did not understand the value they were creating. This model is the answer to their woes."* As a model, participants felt confident that it could explain the way in which HCCs need to transform and therefore guide its management to take the necessary steps in ensuring long-term value for the HCCs, customers and all stakeholders involved.

There were few interactions following review of the model and some participants felt the need to interchange the positioning of DC and RM since it was difficult to establish the same until all DCs were correctly positioned. However, three out of five members were against this view and found RM to have acquired the right place in the SBM. They felt that RM must define the nature and role of CRs and DCs as the opposite scenario would cause the RM to fail by causing unexpected overload from increased expenditure on CRs and DCs. Another valuable suggestion of focus group members was that the SBM was not only dependent on technological innovations in the HCI, but on a careful assessment of all stages of the value creation process, with emphasis on processes that could reduce and remove unsustainable practices and improve reuse of all existing materials and resources. Therefore, SBM enforces fulfilment of the TCs' needs instead of only solving consumer problems, as they are much easier than identifying consumer needs and devising a model that fulfils them. Additionally, this model checks every process for its environmental impact and ensures that resources are saved wherever possible. Use of technology is considered in each process to improve process quality and reduce costs. The final output reflects in a much better RM equation and increases in affordability for the consumer.

In summary, participants in the focus group had a positive view of the final ISM-based SBM that operates on economic, social and environmental principles while keeping customers' needs at the forefront and aligning firms' capabilities accordingly.

As a measure to improve the clarity of the research process the final ISM model presented in fig (6-7) is accompanied by a context diagram of the whole transition process of SBMs, which incorporated the findings from Chapters 3 and 5 and included the views of the participants from the focus group. To reflect an accurate picture on the level of complexity of SBMs and the roles involved in shaping the SBMs, a schematic diagram was drawn earlier in chapter 3 figure (3-9), and further developed in figure (6-8). This figure applies the theories and BM-related frameworks considered, analysed and reviewed in the literature review chapter.

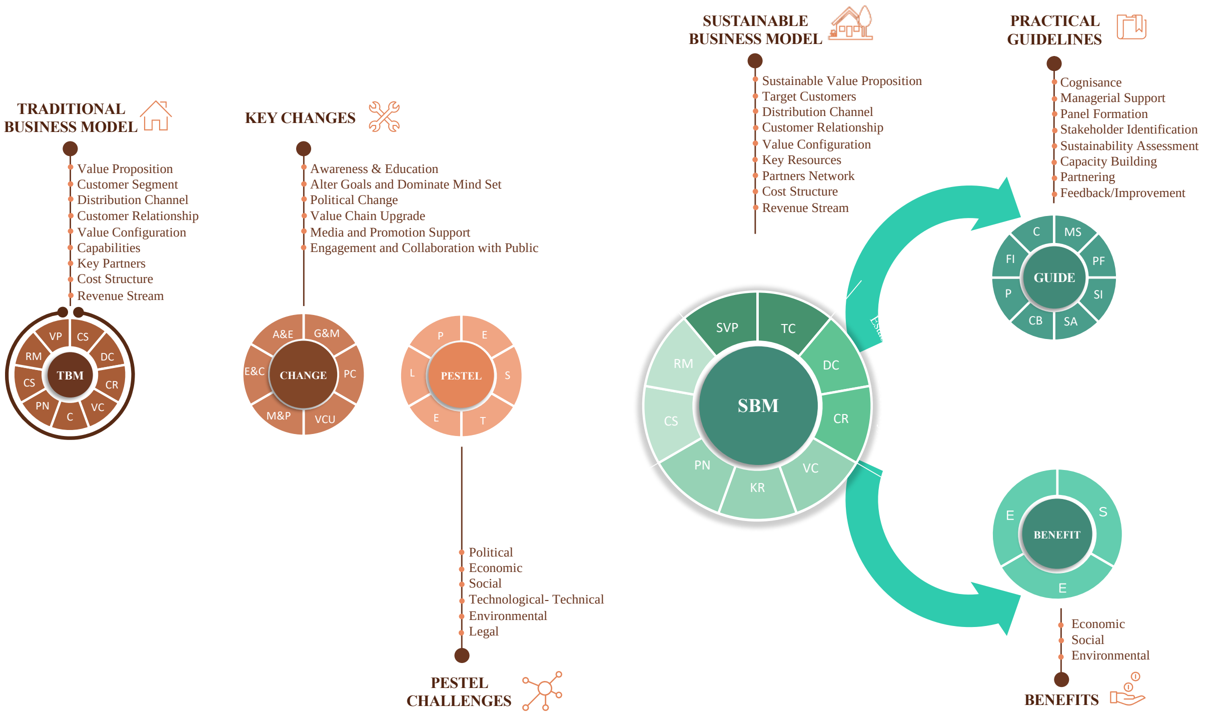

Fig 6-7: Overall schematic view of SBMs transformations

Figure (6-8) represents the way a SBM transforms the processes of value creation, delivery and capture. It shows the various types of driving forces in the market for the change to capture missing value, showing the challenges that it encounters, and the changes required to reduce and remove those challenges at local and national levels. HCCs would experience factors driven by internal and external forces leading to a combined effect of the forces to introduce transformations within the firms and turn them into sustainability-friendly companies that operate on the lines of triple-bottom-line principles. External factors range from political environment to legal and economic improvements. Internal factors are the firms' capabilities to evolve as sustainability experts, leaders and top management demonstrating commitment to this transformational change. Keeping track of the movements of internal and external factors would allow firms to make informed decisions. Changes will occur internally as well as in the overall external environment, which may force an increased rate of adaptation to sustainable development. The process of transformation itself will require a huge commitment to integrating the time and effort of all stakeholders to receive the benefits this model has described.

6.6.2 Validation of SBMs and Guidelines for Implementation

The guidelines are provided as eight-step guidelines for implementation of SBMs by HCCs in HCI. The participants from the focus group were asked to review the guidelines and evaluate the steps for their ease, usefulness and applicability to the entire process. The members were requested to suggest improvements to the guideline and to consider whether reordering was necessary. The findings are organised and presented in the section below.

- **Key Features for Guideline Development and Implementation**

The guideline was shared among the focus group participants as an essential tool for managers and business leaders for implementation of SBMs. For example, FG3 stated that these guidelines are a visualisation of the way HCCs can target sustainable value creation. Therefore, the guidelines are aimed at HCCs' leaders, managers and staff to demonstrate to them that sustainable movement should be driven from and bring change through the combined efforts of all members involved. According to FG4, *"the guidelines are a starting point for HCCs unable to understand how to start working on a SBM for themselves and the projects. I think managers will find it useful."*

FG3 had commented on the circular representation of the guidelines, and this became evident when the feedback mechanism was the final factor that brought continuity to the implementation process. The guidelines focussed more on SBM readiness, on facilitating an understanding of SBMs and providing steps to help create a SBM. The implementation guidelines could have included a model of change management, as reflected in FG1's comment:

"Although it is a good set of guidelines, it is merely an action plan. Real life application is more complicated than this. I understand that there is a list of things to do, but there will be situations where another critical task will demand attention and you may not be able to follow all the steps to reach feedback and review to start the process again. You should

include a model that allows managers and developers to skip steps and enable critical tasks to be executed during this transformation."

Consequently, change management theories and SBM implementation have overlapping boundaries. For example, senior management drives the vision of sustainability in the firm and influences most, if not all, decisions during value creation, delivery and capture. Similarly, motivation for change is also driven by the top management and shared throughout the organisation. Management of the change process is the crucial part that defines its success, as FG3 noted. Therefore, issues of leadership, culture and motivation theories have a place in the model as change management literature has described, However, SBMs adopt a rather holistic approach when combining complex and trivial factors, such as firms' internal processes, capabilities, partnership networks channels, customer feedback and revenue model.

In the words of FG2, the eight steps in which SBMs will require monitoring and reporting may cause conflict in the area relating to recognition of opportunities for improvement, as FG2 explained:

"The steps may end in an everlasting cycle if a continues looking for better opportunities to satisfy customers. A line should be drawn between customers' needs and the ability to serve those needs. If cannot serve a customer's need, it should either pass on the opportunity or develop its capabilities before entering that market. Implementation steps may not be as relevant as you think. There has to be a better approach."

It is evident that FG2 advocated the need for management vision at the highest level to support SBM implementation. In certain scenarios, such as when planning to meet customer needs that its internal processes cannot fulfil, partner networks may come into play. However, it is crucial for small-scale HCCs engaging in large-scale projects to find other methods of value and revenue creation, as not having control of the critical processes can cause instability during value creation, delivery and capture. Likewise, risk-averse companies will take a longer time to successfully achieve SBM implementation and development. Therefore, it is practical to share knowledge and best practices by emphasising the benefits of SBMs along with their ability to stimulate the market and create housing demands that seek value creation opportunities throughout the project lifecycle. The final plan of the implementation guidelines is shown in figure (6-9) below:

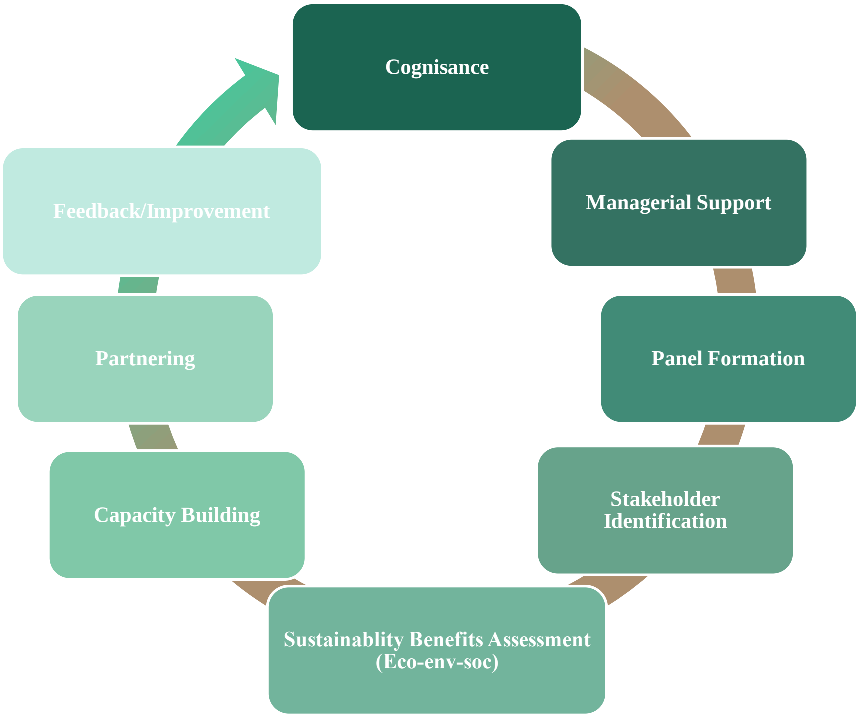

Fig 6-8: Final Version of the Guideline

The figure above presents the final version of the guideline, as informed by the interview findings. The starting point for the guidelines is the HCC's awareness of SBM benefits, recognition of future forces for change and establishment of goals. This view recognises the need to move systematically towards triple-bottom-line principles at the foundational level for building information exchange and decision-making, guided by these ideas. HCCs must understand and spread awareness of problems with conventional construction techniques; for example, high water use and labour-intensive processes, which may lead to failure to operate with this model in future. Therefore, understanding of the problems with conventional development and knowledge of new and sustainable practices must drive the acceptance, commitment, passion and decision-making of firms in the HCI.

Senior management can seek the advice of sustainability experts and arrange meetings in which the expert panel can review designs, project costs and value capture estimates along with business leaders to suggest areas of improvement and possible ideas that can help capture consumer needs more successfully. In cases where the TC is a single institution or a private university, they can be invited for such interactions. Therefore, regular meetings that bring experts, top management, project managers and employees to the same platform and provide them with a common theme, such as SBM creation, would enable stakeholders to understand the value that is being created. Once business decisions are taken and plans are being developed, it is necessary to carry out a sustainable benefit analysis, which will provide a definitive understanding of the goals set out in the project and the probability of their being met through the firm's activities. The analysis comprises not only an assessment of the factors of economic viability in a project, but whether social and environmental sustainability objectives are being met. Therefore, in the event of a clear signal that a firm's activities definitively impact all three areas of sustainability, a HCC must define its set of capabilities that will contribute to the development of the project. Such capacities for transformational change may require formation of a proposal for partnerships with like-minded companies. Creating a partner network for a SBM-based project may eventually grow stronger as firms continue to share the same goals and vision, and seek to achieve them through their products and services. The final stage of the implementation should bring feedback through monitoring of the processes. Any opportunities missed during value creation, delivery and capture should be recorded. Thus, feedback serves as a critical part of the guidelines to develop best practices and learn from mistakes encountered during the project lifecycle.

In summary, the guidelines allow HCCs to find a starting point, based on the range of SBMs transformation options available. The guidelines have taken a broad view of SBM implementation and serve as a template for management professionals to utilise this structure and shape it according to their business requirements. In the field, managers would be tasked with adding details for tasks to be conducted under each step of the implementation guidelines and adapt the guidelines to suit their business environment and culture.

6.7 Recommendations

Based on the outcomes of this research, the following statements are recommendations for accelerating SBM uptake and transformation within the Saudi HCI:

1. HCCs should anticipate and plan for transformation of their conventional BMs to capitalise on the economic success that will come from gaining a competitive edge by introducing sustainability efforts.

2. It is vital to understanding how TCs view SBMs, how to engage them, and how financially forthcoming they will be in connection with the SVPs. HCCs should use this information to help determine their next step, whether to target current existing clients or seek out new clients using SVPs, which is a viable option.

3. Implementation of SBM framework requires more than technology integration and new procedures within the company. It requires partnerships with many stakeholders, such as government officials, financial groups, construction industry leadership, and members of the community.

4. Opening access to financing for HCCs would help initiate innovative sustainable practices. Financial institutions could then be major stakeholders that could influence SBMs' growth and implementation.

5. The public sector in Saudi Arabia boasts of having many HCI consumers and building owners. Clients from the public sector could make a significant difference in the marketplace by supporting and demanding SBM development. Viewing the public as a motivator, as opposed to relying on government and legislative means, would have a more forceful impact on change.

6.8 Summary

This chapter has provided evidence of ISM as a guide used extensively to develop relationships between the multiple SBM elements. The technique was used to represent relationships using diagrams and to show the various elements organised systematically to answer a unique set of problems. The ISM approach has been used widely in sustainability value chain researches for the HCC, which made it a suitable method for this study. The ISM design has created a structured view of the elements in the SBM, based on inputs from focus group members. The structure was developed using the SSIM and arranged according to the nature of the relationship between two elements. As the relationship was identified in each cell of the matrix, they were drawn from the views expressed by the participants. This task contributed to the development of RM using SSIM as input. The driver power and dependency drawings were crucial for the design of the level partitions and each iteration produced clarity for the final design of the SBM. The final ISM-based model depicts the elements and the relationship between elements, using single and bi-directional relationships. Therefore, ISM developed a system-based model, based on the views of the participants in the focus group who have credible experience in the field of sustainability and HCI.

A similar set of activities was performed for challenges to SBM implementation. The ISM, drawn from the experiences of focus group members, identified dependencies among different types of challenges, categorised into political, economic, social, technological, environmental and legal factors. The challenges to implementation of SBMs are issues that should be removed by stakeholders in the Saudi HCI and turned into opportunities for SBM use in HCCs. The process of validation of the model was necessary to improve the quality of the discussions and to ensure all parameters of the model fit together. Research validation helped to ensure that views of focus group participants were conveyed in the right way. This was necessary so that the views of the researcher undertaking the study did not affect the final model and the outcomes of the study. The second round of discussions with the focus group aimed to bring ISM and challenges to SBM to the focus group members so that they could review the model, elements of the SBM and its relationships with other elements, challenges and relationship with other challenges, and implementation guidelines for SBMs together and suggest changes or comment on the nature of the results developed and consider whether it accurately portrayed what researchers believed to be occurring in the HCI. A few recommendations were made during the validation process but, overall, the model was accepted, and the participants were in agreement with the outcomes of the discussion.

CHAPTER 7

Conclusion, Recommendations, and Future Direction

Sections

7-1	7-2	7-3	7-4	7-5	7-6	7-7
Introduction	Revisiting Aim and Objectives	Contributions	Implications	Limitations	Future Direction	Concluding Remarks

Chapter 7. Conclusion, Recommendations and Future Direction

7.1 Introduction

This study illustrates the absence of integration of SBMs within the HCI, which was introduced in Chapters 1 and 3. The aim of the study is to provide a definition of the SBM, discuss the nature of its structural framework and then provide guidelines for SBM integration in the Saudi HCI. To accomplish this, four research objectives have been created and presented in Chapter 1. This Chapter, Chapter 7, discusses the accomplishment of the aim and objectives in Section 7.2, followed by a review of the contributions of the study in Section 7.3. Implication of this study will be explored in Section 7.4 and limitation will be reviewed in Section 7.5. Recommendations to assist with increasing acceptability of SBMs in the HCI are further explored in Section 7.6. Section 7.6 suggests direction and thoughts for future research in sustainability practices in the HCI, before closing with concluding remarks in Section 1.8.

7-1	7-2	7-3	7-4	7-5	7-6	7-7
Introduction	Revisiting Aim and Objectives	Contributions	Implications	Limitations	Future Direction	Concluding Remarks

7.2 Revisiting research aim and objectives

SBMs are perceived as a new approach in the HCI as they serve as a connecting point between sustainability in the BMs and the HCI domains. The aim is achieved through several specific research objectives, including the fields of both the BM and the HCI. The key findings are presented below:

Objective 1 – To analytically investigate the current state of SHPs beside challenges that slow the uptake and understand the link between sustainability and business success in the HCI through a BM lens

To begin to comprehend the basic principles or core foundation of sustainability practices and recognise opportunities for economic feasibility in the HCI, it is essential to examine previous studies and literature. To gain an understanding of these principles, a literature review has been conducted, including a broad range of features regarding the topic of sustainability. This has contributed to the initial part of the foundation in Chapter 2, which sought to identify best practices of sustainability and highlight common challenges within the industry using a PESTEL analysis. Chapter 2 has focussed on exploring the challenges that affect the implementation of SHPs, helping to draw the connection between sustainability performance and business success in order to support the sustainable business case for the HCCs. The benefits of SHPs have been highlighted, which will attract HCCs to adopt and implement SBMs within their companies. Challenges faced by HCCs while implementing sustainable changes have been discussed, illustrating how sustainability can generate profit but also involves potential risk. To create a viable business case, HCCs should perform an analysis to further explore these creation levers, remaining aware that they may need to include further appropriate levers to help implementation.

This has presented a challenge to business practices as many of the major value creation challenges are difficult to convey in financial terms and, consequently, may not attract the attention of HCCs. Consequently, many HCCs engage in disconnected sustainability initiatives that fail to utilise the entirety of the economic potential embedded in sustainability practices. Chapter 3 has also highlighted the benefits of partnering with sustainable value chain to assist with development and operations when proposing sustainable value propositions (SVPs). The SBMs operates to promote, advertise, and communicate the benefits offered by SVPs. A major finding showed that sustainable values still lack utilisation to their full potential within the HCI. Chapter 3 proposes that implementation of the BM approach should guide SVP uptake and uphold the potential benefits.

Objective 2 – To systematically discuss the emergence of SBM concepts in the housing and construction discipline in order to define, develop and conceptualise the elements needed for the structure of a SBM framework

Objective 1 has revealed the business case of sustainability and the challenges that HCCs are facing while engaging in sustainability initiatives that often fall short of tapping into the economic potential that true sustainability practices can offer. The disconnected procedures are not the only issue and fail to address the whole construct of the BM. HCCs are failing to use a systematic approach to create and change the fundamental underlying structure of their traditional BMs to transform them into sustainable practice and make profits at the same time.

Supporting objective 2, the literature review investigates the role of the BM structure and the complexity of the economics of sustainability. Chapter 3 discusses the introduction of the SBMs in the HCI. The chapter provides (1) a review of the BM literature available in the building and construction sector, identifying key concepts, discussing similarities and differences; (2) a focus on sustainability initiatives within the BM and how that translates to economic success; (3) identification of a research gap; (4) new definitions and constructs for the development. Additionally, it concludes that BMs and strategy are closely interlinked and clarifies this connection, also establishing that BMs are viewed as a connector between the strategy and operations of the company. The findings acknowledge BMs delivering insight into the creation of sustainable value and the delivery of profitable products, while simultaneously satisfying consumers. Additionally, they show that BMs have been used in various sectors, including information communication technology (ICT), computer integrated technology (CIC), off-site construction (OSC), timber-framed construction (TFC), industrialised building (IB), partnerships and alliances between companies, intellectual capital (IC), waste reuse (WR), energy service companies (ESCO), energy retrofit (ER), customer-oriented value propositions, product service systems (PSS) and public private partnership (PPP). Finally, it concludes that a definition of the SBM and its constructs is needed to formulate the journey to sustainability transition.

In more recent years, demand has increased for examination of SBMs and their utilisation in sustainability studies within the building and construction field. The significance of the SBM originates from its focus on the way different constructs of an organisation collaborate as a whole. The SBM approach will create methodical and radical change in how they transform and successfully implement sustainability within the HCCs. The literature review supporting objective 2 has contributed to achieving objective 3, due to SBM research being in its infancy stage at this point. These findings have contributed both theoretically and empirically to the advancement of research in this field, as discussed in Section 7.3.

Objective 3 – To define and conceptualise SBMs, identify anticipated changes, challenges, and benefits associated with implementation

To accomplish this objective, Chapter 3 investigates SBMs as a link between BMs and SHPs. The objective was attained both through the literature reviews in Chapters 2 and 3, and the empirical data that was collected and then shared in Chapters 5 and 6. A lack of standardised definitions of SMBs has been identified in the available literature in the HCI. The few definitions discovered, imply that SBMs improve overall processes. Furthermore, the studies declare that modification in the original BM elements will be established in the value propositions suggested by the organisations. As a result, the starting point of the path towards sustainability is analysis of the existing BMs to facilitate the process of shifting to a SBM. The following are the collective elements of the SBM:

- The SVP is categorised as the element responsible for delivering products and services to meet customer expectations. The start of the development of SVPs is initiated by gathering and investigating customer needs and requests, identifying their basic necessities in relation to future homes and then turning this information into the product or service desired. The ultimate goal is to create low cost SVPs while minimising the impact on the environment, which, in turn, will increase gains within societal views. HCCs must examine and redefine their original BM elements to successfully develop sustainability within the organisation, which would provide the flexibility needed to meet ever-evolving client needs and requests. SVPs are essential for the continued growth and development of a HCC, adapting to the demands and expectations of the target customer (TC), which is the next element to be discussed.
- The TCs, sometimes referred to by HCCs as the possible customers, are the target of marketing efforts, carefully selected due to the company's belief that the SVP of some particular product or service will appeal to them, gain their approval, and entice them to purchase. In order to expand SBM markets, the SBM must continuously evolve to keep up with TC needs, remaining flexible and creating unique SVPs as trends change. The most recent, younger generation of TCs tend to be more aware of how sustainability affects society and the environment, equating demand for products and services with low impact on the environment and society. While

sustainability may be the main concern for one TC, another TC may demand low cost as the primary factor in initiating service or purchases in the HCI. The SBM must be knowledgeable about current trends and how they affect the TC.

- The DCs or planned and efficient ways for connecting products or services to the consumer. DCs take many forms and must remain flexible in order to keep up with trends and the preferred avenue for connecting with the TC. Currently, digital marketing methods are trending upwards in popularity, allowing SBMs to connect with value chains, such as TCs, investors and suppliers. A sales team could be the chosen DC for reaching out to TCs to strive to understand how to best accommodate their needs. DCs help to lay the groundwork for establishing relationships with current and future consumers.
- The CRs create efficient, ongoing connections between the consumer and the company for engaging with and improving the consumer's experience. The CR will play a role in contributing to the implementation of the SBM by educating consumers about the benefits of sustainability and also incorporating better practice by taking constructive feedback from the consumer. The CR, along with the DC mentioned above, will play a significant part in building a case for the SBM throughout feedback and recommendations for improvement.
- The VC is the inner workings of a company, outlining the resources and activities that are necessary for delivering the SVP, taking into consideration the demands of the consumer. HCCs that intend to embrace sustainable practice and transition their existing BMs into SBMs will find that they need to implement changes in several areas of the company. The VC will provide guidance for the necessary changes in all aspects of the company's transition, including marketing, financial areas, purchasing, design, etc. The HCC must be able to provide key resources for the change in processes to enable the continuous functioning of the VC.
- The KRs are those important resources that assist in creating and delivering value to enable the SBM to work efficiently. Changes in resources to help support the switch to a SBM will affect many departments and suppliers, ranging from human resources all the way to physical resources used for construction. KR will play an essential role in designing SVP, incorporating sustainability principles.

- The PN, the supportive element presented in the SBM, is a team that works together to foster growth and benefit for everyone. It plays a major role in supporting the development of SBMs and SVPs. The PN will join forces to oversee and guide the process of development of the SBM, enhancing the VC and CC.
- The CS is the detailed description of the costs associated with developing and maintaining a SBM, including both variable costs (labour and materials) and fixed costs (salaries, utilities, rent, marketing budget). Formulating an estimate of a CS is a challenging process, but it is needed to support transformation to the SBM. Knowledge and understanding of the company's TC and SVP will assist with the estimate. The CS will also contribute to other elements, highlighting the newly needed key resources and projects that are costly and time-consuming, while allowing the PN to focus on these issues to adjust accordingly.
- The RM reflects a version of the cost structure to identify profit for the SBM. The company will create measurable value by confirming benefits during the creation of the RM and share these with consumers and partnering networks. The RM will ultimately become the foundation for the construction activities and transitions, and will act as a motivator to integrate the SBM with the original BM.

In addition to SBM development, the study discusses changes associated with transition to SBMs. Changes required by HCCs are divided into six categories: awareness, alter goals and dominate mindset, political change, value chain upgrade, media and education support, engagement and collaboration with the public. Transition to a SBM will affect all areas of an HCC, demanding change at all levels. It is essentially like a domino effect, a change in one of the elements listed above will force change in other elements.

Challenges faced by HCCs regarding SBMs are categorised into six groups, using a PESTEL analysis. This study reports that social challenges are considered the highest priority to address, followed by legal, political, technological, economic and environmental challenges.

The social, economic and environmental benefits gained when developing SBMs are reported in this study. HCCs must evaluate and balance short- and long-term financial benefits in order to be open to the gains offered by the SBMs. Concentrating and highlighting the benefits offered will result in successful development and transition to SBM.

The first three objectives, shared above, are then consolidated to achieve the final objective, which presents guidelines, aiming to offer support and assistance to HCCs' top management teams when implementing SBMs.

Objective 4 – To propose and validate the SBM framework and guidelines for implementation in the HCI

Building on Chapter 5, Chapter 6 discusses the SBM framework elements and highlights the links between them. By incorporating the ISM, Chapter 6 illustrates the evolving and mutual relationships between the SBM elements, confirming that all the elements listed are linked. Using the ISM analysis, the SVP and TC are found to be crucial elements, otherwise known as driver elements. These two elements can be viewed as the building blocks for transformation and development of SBMs. Transitioning into a SBM means having to change current elements, which can prove to be a challenging process. HCCs must first understand consumer needs and demands in order to turn them into SVPs that reflect the principles of sustainability practice. When they have become knowledgeable regarding TC needs, the company must review the CS and decide whether they are able to meet the demand, and whether it will bring profit to the company, with VC and KR playing key roles. Companies will turn to PN to help reduce cost if VC and KR are not able to meet TC needs due to high costs. The RM will be analysed for additional revenue streams and then incorporate these new prospects into the SVP. In depth knowledge of the RM will assist companies in utilising and adjusting appropriate elements in order to maximise profit. Comprehension of the RM will assist companies in utilising the appropriate DC and CR methods for each TC. The SBM elements presented in reference to the ISM hierarchy were well-received and endorsed by a focus group made up of experts from the HCI.

Owing to the lack of literature focussing on SBM approaches in the HCI, it was pertinent to examine the challenges and struggles that occur when implementing SBMs. This study identifies challenges associated with SBMs, and the relationship between them. As seen in Chapter 6, ISM is used to address these challenges, and to identify core challenges that have an effect on others. The ISM hierarchy confirms finding from the qualitive round and places social challenges on the bottom level; i.e., the level of highest importance. Listed above are economic, environmental and technological challenges, along with other difficulties associated with implementation of a SBM. In the economic category, 'limited initiatives', 'high up front' and 'low demand' for a SBM are reported as factors leading to its low acceptance in the HCI. Environmental challenges, such as 'shortage of natural resources' and 'high waste industry' are reported. Technological constraints, such as 'low levels of ICT adoption' and 'low innovation capabilities' in the construction sector are reported by participants of focus groups. While economic, environmental, and technological issues are seen as problems, there was little to no influence over one another, therefore all three challenges were considered top during the ISM challenges.

The second iteration showed political and legal challenges as the next level of priority. Key themes that emerged were, 'absence of legal framework for sustainable construction', 'lack of collaboration between stakeholders', 'unclear building code', and 'lack of inclusion in procurement arrangement', which functions to protect from financial losses. Additionally, another theme providing insight into political challenges of 'political commitment and will of leadership' emerged as the next big issue. This refers to political leaders fulfilling commitments publicly stated and agreed upon. If political officials stood by and followed through on their promises, there would be less of a need to promote and push for sustainable practices. The last and noted highest level of importance was reserved for social challenges. The public shares a common hesitancy to fully embrace SBM due to uncertainty about quality and performance. As the SBM is fairly new to the public eye, the absence of long-established records or examples of SBMs causes consumers to be hesitant in making investments. However, these hurdles can be overcome when consumers are aware of the benefits of sustainability, including economic and social investments, and how sustainability affects the environment and improves the planet. Themes such as 'lack of awareness' are a main factor in the slow uptake of sustainability in HCIs in the Saudi HCCs; industry and political leaders stating they are unaware of the long-term benefits.

It is essential that leaders and top management in HCCs learn to embrace these challenges and recognise that SBMs are built upon an innovative style approach. The guideline for implementing a SBM is summarised below and is constructed in eight phases. More details and information are outlined in Chapter six.

The starting point in the guideline is the HCC's awareness of the demand for SBM benefits and recognition of the necessity to move towards triple-bottom-line principles as the foundation upon which goals can then be built. HCCs must be able to acknowledge non-sustainable practices within conventional construction, such a high water use and disposal of materials, and actively spread awareness of the lack of sustainability in this model. Understanding the issues with conventional construction, coupled with awareness of new sustainable practices must be the driving force of the commitment and decision making of HCCs. Sustainability experts are available to support senior leadership efforts for implementation by reviewing cost projections, design reviews, and VC estimates and guiding practices to help deliver solutions to consumer needs. Regularly bringing together experts, top leadership and employees to align with SBM development will give confidence to the stakeholders of the value and benefits. When decisions and plans are laid out, a sustainable benefit analysis must be performed to summarise understanding of the target goals and objectives. This process also measures the success of the stated environmental and social sustainability objectives. When a firm has confirmed that it is able to positively impact all areas of sustainability, the it must define its ability to work towards the stated goals. The ability for successful transformational change may be dependent on forming partnerships with similar minded companies for additional support. Choosing to engage with a partner network for SBM projects may ultimately benefit and continue to grow stronger as more and more firms implement sustainability and share common goals, striving to promote new products and services. Finally, in order to track and evaluate the implementation process, feedback should be monitored and acknowledged. Opportunities missed or any miscalculations should be documented. Continuous monitoring and feedback are critical to the project, as this helps to develop guidelines and best practices.

7.3 Original contributions of the study

This study strives to address a gap in the literature regarding SBMs, specifically in the HCI. This research investigates the implementation of SBMs in the Saudi Arabian HCI and the associated changes, challenges and benefits that accompany the integration. The results contribute to the field of SBMs, specifically guidelines for successful implementation, and to the overall literature of the Saudi housing construction industry.

Theoretical contributions

The contributions presented in this section are solely connected to the literature reviewed and studied for this research. Section 3.3 provides further review of the literature review process. This study presents a comprehensive literature review of the SBM approach, providing both a definition and elements for the establishment of the framework.

Previous studies in the HCI literature lack SBM review and implementation. To address this gap, this study has thoroughly reviewed the literature available, noted in Chapter 3, to gain insight and examine patterns of BMs in the HCI. Through the literature review, this study has reported the emergence of BM approaches in both the business management area and the HCI. A list of relevant studies has been provided as well as a chronological chart to follow the evolution of SBM research as it applies to the HCI. In addition, it has accounted for the most up-to-date research trends and discussed suggestions for future research regarding SBMs in the HCI.

BM elements required for the development of the SBM framework are examined in this study from the existing BM literature available. While there is much literature pertaining to the elements of a BM, there is no standardisation or consensus as to what specific components should be in the SBM. There is consistency throughout the literature regarding the names or labels of the elements, but the definitions vary, potentially causing confusion and possibly interpreting incorrect meanings. This study has worked to identify the common components of a BM and presented a summarised list of elements, in section 3.5, that make up a SBM. Following consolidation of overlapping elements, the final list of elements provides building blocks for the SBM framework. These elements can be applied to future research into the development of SBMs.

Practical contributions

Based on empirical data from the Saudi HCI, this study has reflected a new and practical guideline and application of SBMs. The study has presented a guideline for implementing a SBM framework, which strives to benefit HCCs and their top leaders. The guideline has been developed and then validated through expert interviews and focus groups. These guidelines are presented to assist and support the transition of HCCs from conventional operations to sustainable practices to seize future opportunities. The study introduces opportunities for organisational change and provides insights into how top management can implement SBMs into their companies.

7.4 Implications

This study has informed both research and business practice in multiple ways; discussion follows below.

Implications for research

- With limited research having been undertaken previously, this study provides an in-depth understanding of SBMs within the HCI, providing a foundation for future studies
- This research provides a theoretical frame for future research relating to SBMs in the HCI. The frame developed implies that research should lay the groundwork by providing explicit definitions of SBMs and their elements to reduce confusion around the concept. Developing a common language regarding elements of a SBM will enhance quality and depth of future studies.
- The research illustrates the basic elements of a BM, as included in most BM literature found in business management. This adds strength to the notion that a BM plays a key role in developing and maintaining value, an idea that is fairly new in the HCI context.

- Previous literature has implied that the power of the SBM is derived from the connections linking the elements. This study proves this connection by using the ISM technique; essentially, confirming the strength of the SBM approach.
- Many scholars have argued that market drivers play a key role in tackling sustainability issues. This study supports this idea by highlighting the economics of sustainability issues, using sustainable value creation, and capture and delivery advocates for integration of SBMs.

Implications for practice

- While the HCI has begun to address the issue of sustainable practice in its products and services, this does not fully encompass the full concept of sustainability. This study does not focus on capitalising on products and services, but encourages change in procedures, such as focussing on customer relationship and distribution channels. Systems throughout the whole BM should be modified to be fully beneficial.
- As the idea of sustainability increases in popularity and demands increase and disrupt the structure of conventional BMs, SBMs have the potential to support major transformation and provide an opportunity to transform the entire industry.
- Sustainable value creation, capture and delivery require effort and careful planning from leadership and managers to work effectively. Top management must have a current understanding of value creation, in addition to the capture and delivery logic and knowledge of how they work together as a system. The SBM elements generously lend top management a way to view the functioning of their conventional BMs, enabling them to modify performance and develop ideas for new SBMs.
- Sustainability can provide a new competitive advantage in the market. By understanding the current BM, management can use this knowledge to stay competitive and strengthen their position in the market by creating sustainable practices.
- Creation of the elements of the SBM should never be independent of each other; instead, focus should be on integrating the elements, reinforcing the whole system. The systematic effect is essential for the success of SBMs, not the details of each element in itself.

- SBMs focus on TCs and what they demand; acknowledging their perspective. When a HCC works with the SBM approach, it forces them to concentrate on the TC, as opposed to a cost-driven approach. This increases their ability to focus on delivering value products that satisfy TCs, which differs from the approach typical of that used in the HCI.
- SBMs provide sustainable practice in turn, which can translate into actual sustainable growth and business strategy, functioning within the HCC structure.
- The entirety of the system must revolve into sustainable practice for sustainability to be successful within HCCs. This study has examined challenges, not only within individual companies, but also within the overall industry.
- The guideline developed in this research views top-management as crucial during the change to an SBM. As the SBM becomes integrated within the company, the role of top management becomes less essential.

7-1	**7-2**	**7-3**	**7-4**	**7-5**	**7-6**	**7-7**
Introduction	Revisiting Aim and Objectives	Contributions	Implications	Limitations	Future Direction	Concluding Remarks

7.5 Limitations

This section explores the limitations by discussing the overall limitations and providing commentary on its validity and reliability.

While the main aim and objectives of this study have been met, this section will illustrate the limitations:

- There are no specifics on how to actually apply the new SBM framework in practice or offer specific methods to support HCCs in successfully achieving sustainability goals through the integration of the SBM. The elements of the suggested SBM should be used as a general guideline to develop SBMs, but each individual HCC should adjust to fit their own capabilities. The HCI has broad scope and coupled with the complexities of introducing sustainability, it faces challenges. No two housing delivery markets are the same; they differ in numerous ways, such as business organisational structures, value propositions, governance, and rules and regulations, ensuring that the path to sustainability is different for everyone.

- In this study, the sample size is small although participants work within large HCCs. Due to the scope and integrity of the data, the findings may apply to any HCC, but smaller companies are not represented in the sample and the research findings might not apply to them. For future research, findings would require validation in a larger and more representative sample.
- Despite the importance of the SBM approach, it remains an under-researched topic in the HCI, making it challenging to find comparable studies. There is no quantitative data available in the literature to either add to or dismiss the conclusions drawn from this qualitative study.
- This study focusses on the entire value chain in the Saudi HCI. Although efforts were made to include all the value chain players, it proved to be difficult to include everyone, such as material suppliers and manufacturers.
- This research is focussed primarily in the Saudi HCI context and data was only collected from this resource. A comparative study would benefit from inclusion of other countries, generating additional data for interpretation in different contexts.
- All data collected is self-reported by the participants and has the potential to be guided by personal bias or lack of knowledge in the subject area. These biases could be systematic, as all the participants met certain criteria, as listed in Subsection 4.8.10. There is also potential for feedback loop, between the time the framework is developed and later in the investigation, due to exposure to theory, education, training or communication with consultants.
- This study contributes to the theory and subsequently adds to the minimal research that is available in the HCI, although the conclusion of this investigation is perceived as a transparent qualitative hypothesis, yet to be supported quantitatively.

7.6 Future direction

This section suggests opportunities for future research:

- There is lack of research available that reviews the integration of financial, environmental and social sustainability in the HCI. The proposed SBM framework in this study can be used as a tool to further investigate and be used as a foundation to expand work on conventional BMs and SBM integration. While the proposed SBMs have been applied theoretically, they have not been applied practically and the research of SBMs in the HCI is still in its infancy stage. A practical approach can direct and explore how the framework affects the marketplace.
- A quantitative project with an increased sample size would be considered an asset, to confirm and validate the outcomes of this study. While this study is founded on a wide business literature foundation, the BM and SBM literature would benefit from future empirical studies.
- The provided guideline can be applied and analysed to gain insight into the nature of SBMs.
- This study has focussed on providing, defining and exploring nine elements of the SBM. Creating a set of variables for each element may provide further insight into the development of SBMs.
- The stakeholders within the HCI must work together as a network in order to successfully implement an SBM framework. Future studies could investigate how BMs can collectively work in sync to create value for TCs and ensure it is profitable. Collective BMs would provide information about the construction industry and help conquer the fragmentation occurring in the HCI.
- This study concludes that unawareness is the primary barrier to SBM transformation, which is contradictory to other studies that suggest that the SBM is a major force for sustainability reform in the Saudi HCI. Future studies could investigate ways to enhance awareness of sustainability in the HCI.

7-1	7-2	7-3	7-4	7-5	7-6	7-7
Introduction	Revisiting Aim and Objectives	Contributions	Implications	Limitations	Future Direction	Concluding Remarks

7.7 Concluding remarks

This study has presented the BM approach to better comprehend the effect of sustainability practice on the economic indicators of HCCs, producing a guideline intended for SBM framework implementation in the Saudi HCI. The guideline supplies HCCs' leadership with the concepts of the elements and relevant details to transform a conventional BM into a SBM, tackling sustainability issues. The SBM elements illustrated are derived from business management literature and introduced to the HCI. This study supports the connection between SBM elements and the theoretical notions regarding the structure of SBMs, and the significance of working collectively, as opposed to working on an individual level. This research has the potential to shape the implementation and policy of sustainability and HCI practitioners, academics, policymakers and financial institutions would benefit from reviewing the outcomes.

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Appendix 1

Participant Invitation Letter

Participant Invitation Letter

Dear Mr/Mrs:

I am Adnan Alshahrani, researcher in the school of Built Environment/ University of Salford, Manchester, UK.

The research project that I am currently undertaking sets out to develop a framework that answer how can housebuilders companies and organizations successfully develop sustainable business models based on sustainable value offers, thereby improving financial, environmental, social performance.

If you agreed to take part in this research, you will be contacted by me personally bearing in mind that the data will be collected in two phases. The interview involves answering a set of questions provided via a questionnaire form.

I can promise you that I will take all the required ethical concerns into consideration. You may decide to stop being a part of the research study at any time without explanation. In addition, the data I will collect will not contain any personal information. No one will link the data you provided to the identifying information you supplied. Any other ethical issues related to the research philosophy are considered by the researcher and the University of Salford. The Ethics Committee of University of Salford has granted ethical approval for this study.

Your response is truly important to the success of this study. I would like to assure you that your response will be `Strictly Confidential' and will be used for academic purposes only.

If you decide to participate please sign this paper for me if you are happy to take part in this research and interview. If you have any questions or concerns about the study, please contact me.
My e-mail is:
1- Mobile phone: 07553159670
2- Email: A.Y.Alshahrani@edu.salford.ac.uk
Thank you for your time and consideration
Yours sincerely,
Researcher Name: Adnan Yahya A Alshahrani
Room 413, School of Built Environment
4th Floor, Maxwell Building,
University of Salford, Salford
United Kingdom
M5 4WT

Participant's name (printed) ______________________

Participant's signature ______________________

Date ______________________

Appendix 2

Research Participant Consent Form

Research Participant Consent Form

The Application of the Sustainable Business Models within Saudi Arabia Housing Construction Industry

Name of Researcher: Adnan Alshahrani- PhD Student
School of Build Environment – University of Salford
E-mail: A.Y.Alshahrani@edu.salford.ac.uk

Thank you for agreeing to be interviewed as part of my PhD Research into the research to answer how can housing construction industry and organizations successfully develop sustainable business models framework based on sustainable value offers, thereby improving financial performance? If you feel like you may not be a sustainable business, no worries. We want to recognize businesses that are sustainable already, as well as help those who would like to learn how to be more sustainable.

As an interviewee in this project:

- Your participation is entirely voluntary;
- You are free to refuse to answer any question; and
- You are free to withdraw at any time.

The interview (and/or any other materials related to the interview) will be kept strictly confidential and will be available only to members of the research team. The interview data will be kept in a secure environment at the University of Salford.

You will be given the opportunity to verify your interview transcript and to check the project report for accuracy prior to publication

Please sign this form to indicate that you have and understand the above.

______________________________ (Signed)

______________________________ (Printed)

______________________________ (Date)

Appendix 3

Participant Information Sheet

University of Salford MANCHESTER

Participant Information Sheet

Title of Study: ***The Application of the Sustainable Business Models within Saudi Arabia Housing Construction Industry***

What is the purpose of this study?

The main aim of this research is to develop a framework for the sustainable business models that answer how can housing construction companies and organizations successfully develop sustainable business models based on sustainable value offers, thereby improving financial, environmental, social performance.

Do I have to take part in the study?

Participating in this study is completely voluntary and you may withdraw at any time. Also, even after agreeing to participate in our study, you are still free to withdraw at any time and without giving a reason.

What will happen to me if I take part?

You will be interviewed at a location of your preference. The whole interview will take approximately less than 60 minutes to complete. The transcribed data will be sent to you for confirmation. With your permission, the interview will be recorded. The recorded interview and information will only be used anonymously and for academic purposes. It will not be possible for any participants be personally identified. Individual's information such as name, gender, age, ethnicity, religion will not be revealed under any circumstances.

Meanwhile, we would like to indicate to you the following points for which your consent is needed and this is completely up to you. We will only use the records in ways that you agree to:

1. In any use of these records, your personal information will not be identified.
2. The anonymised records can be studied, transcribed and analysed by the interviewer only according to the research aims.
3. The anonymised records can be used for scientific publications and/or meetings.
4. The anonymised records can be shown in presentations to scientific or non-scientific groups.

Please be assured that confidentiality is highly protected for this survey. The transcribed interviews will be kept with no identifying information. The personal information collected about you in the beginning of the interview is only for discerning patterns in the data collected and could never be used to identify you personally. All data collected will be kept and accessed only by the researcher and the supervisor of this research and will never be made available for other parties or be made public.

What are the potential risks, discomforts and inconveniences from taking part?

There will be no possible disadvantages and risks whatsoever for participating in this study. This is because the research study only deals with limited respondents and only deals with the technical issues. As participation is voluntary, you may discontinue the interview at any time or choose not to answer any particular question, or not to participate at all.

Yours sincerely,

Appendix 4

Ethical Approval Letter

Research, Innovation and Academic Engagement Ethical Approval Panel

Research Centres Support Team
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University of Salford
M5 4WT

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28 November 2017

Adnan Alshahrani

Dear Adnan,

RE: ETHICS APPLICATION STR1718-03: Business Model innovation for the Delivery of Sustainable Housing in the Kingdom of Saudi Arabia (KSA)

Based on the information you provided, I am pleased to inform you that your application STR1718-03 has been approved.

If there are any changes to the project and/ or its methodology, please inform the Panel as soon as possible by contacting S&T-ResearchEthics@salford.ac.uk

Yours sincerely,

APHigham.

Dr Anthony Higham
Chair of the Science & Technology Research Ethics Panel

Appendix 5

Semi-Structured Interview Questions –2017-2018

Semi-Structured Interview

Participant's ID ___ ___ - ___ ___ ___

City and Cod ___ ___ _____ ___ _____ ___ ___- ___ ___

Date of Interview ══ ══ ══
DD MM YY

To be completed at time of data entry:
Date of data entry ___ ___ ___ ___ ___ ___
DD MM YY
Initials of data entry staff _____

Initials of Interviewer __ (minimum of 2 letters)

A. Background and Demographic: معلومات عامة إحصائية	
Type of organization نوع المنظمة او الشركة	
Job title/ Education degree المنصب الإداري / المسمى الوظيفي	
Years of experiences عدد سنوات الخبرة	
Size of the company حجم الشركة و عدد الموظفين	
Education level المستوى التعليمي	

B. Traditional Business Model describes the rationale of how an organisation creates, delivers, and captures value that includes the modelling and description of a company's value propositions, target customer segments, distribution channels, customer relationships, value configurations, core capabilities, partner network, cost of structure and revenue model **In light to the above definition** **من خلال التعريف السابق هل من الممكن إجابة التالي**	
1- Do you see any possible business case for sustainability in the housing construction businesses? هل ترى ان الاستدامة تشكل فرصة تجارية تستحق في مجال تجارة الإسكان ؟	Probe: yes/no Why not adopted? Untapped? اذا كنت ترى هذه فرصة/ او لا/ لماذا من وجهة نظرك لم تقتنص هذه الفرصة؟
2- How you can define sustainable business model (SBM)? More specifically for the housing construction industry (HCI)? Please give details and examples? هل تستطيع تعريف نموذج العمل المستدام؟ بوجه الخصوص في قطاع الإسكان؟ و هل من الممكن تزويدنا بتعريف بعض الأمثلة؟	Probe: Where the changes will be located? اين ترى التغيير يجب ان يحدث في النموذج التقليدي لكي يصبح مستدام؟

C. Sustainable Business Model Elements نموذج العمل المستدام **In light toward the change toward SBM and the business case for sustainability please explain the following** **من خلال القاء الضوء على تعريفك الخاص بهذا المودل المستدام هل من الممكن ان تجيب على الأسئلة الآتية**	
C.1. Value Proposition القيمة المقترحة	
1- What is the value proposition for SBMs? ما هي القيمة المقترحة للاستدامة	
2- How the VP will change as a result of sustainability movement? كيف ترى القيمة المقترحة سوف تتغير نتيجة التوجه نحو الاستدامة؟	
C.2. Target Customer Segments الفئة المستهدفة/ المستهلكين/ المستفيدين	
3- Who are the customers of sustainability movement and	4- How the TC will change as a result of sustainability

practices? And who are the biggest group? من وجهة نظرك من يكون عملاء القيم الحركة المستدامة؟ ومن هي أكبر شريحة من المهتمين بالتركيز على هؤلاء وتلبية أهدافهم؟	movement when targeting customers? كيف ترى هذا العنصر الخاص بالمستهلكين في نموذج العمل سوف يتغير نتيجة التحول للنموذج المستدام؟
C.3. Distribution Channels قنوات التوزيع	
5- How SBM reaches customers? كيف ترى ان النموذج المستدام يتوصل الى العملاء؟	6- How the DC will change as a result of sustainability movement? كيف ترى هذا العنصر الخاص بالوصول للعملاء في نموذج العمل سوف يتغير نتيجة التحول للنموذج المستدام؟
C.4. Customer Relationships علاقات مع العملاء	
7- How SBM establish a relationship with customers? Explain please with examples? كيف تخطط نموذج الاعمال المستدام في العلاقات؟ شرح مع ذكر امثلة ان امكن؟	Probe: What type of relationship you are looking for? ما هي أنواع العلاقات التي يرجوها النموذج المستدام مع المستهلكين؟
8- How CR will help toward the SBM transformation? كيف هذا العنصر سوف يساعد النموذج التجاري للتحول نحو الاستدامة	How the CR will change as a result of sustainability movement? كيف ترى هذا العنصر الخاص بالعلاقات في نموذج العمل سوف يتغير نتيجة التحول للنموذج المستدام؟
C.5. Value Configurations مراحل خلق القيمة	
9- What are the activities and process needed/ or to be aware for SBMs? List please? ما هي المراحل والخطوات التي يحتاجها نموذج الاعمال المستدام لديك الان؟ اذكر المراحل قدر الإمكان؟	Probe: Are the activity different from the traditional BM project? هل الأنشطة والمراحل مختلفة عن النموذج التقليدي؟
10- How do you arrange activates and process when adopting SBMs? كيف يتم تنظيم هذه المراحل والخطوات عند الشروع في النموذج المستدام ؟	How the VC will change as a result of sustainability movement? كيف ترى هذا العنصر الخاص بالأنشطة والمراحل في نموذج العمل سوف يتغير نتيجة التحول للنموذج المستدام؟
C.6. Core Capabilities هيكل القدرات	
11- What are the key resources and capabilities needed/ or to be aware for SBMs? List please? ما هي القدرات التي يحتاجها لديك نموذج الاعمال المستدام؟ مع ذكر القائمة	Probe: What changes requires in the capabilities when involve in SBMs? كيف ترى هذا العنصر الخاص بالقدرات في نموذج العمل سوف يتغير نتيجة التحول للنموذج المستدام؟
12- Which organisational capability are the most critical when developing SBMs? ما هي القدرات اللازمة لتغيير هذا التحول للاستدامة؟	
C.7. Partner Network شبكة الشركاء والمتحالفين	
13- Who are the partners or collaborators needed to acquire and exploit capabilities and competences of other firms either within or outside their partner network? من في رأيك الشركاء الذين يحتاج اليهم النموذج المستدام؟	Probe: When developing SBMs/ what partnership you are in need for to develop the project? عند ما تم الشروع في النموذج المستدام ما هي العلاقات التي تريدها في كل الشركاء؟
14- How the PNs will change as a result of sustainability movement?	

كيف ترى هذا العنصر الخاص بالشركاء في نموذج العمل سوف يتغير نتيجة التحول للنموذج المستدام؟	
C.8. Cost of Structure هيكل التكاليف	
15- What is the CS in SBMs? ما هو هيكل التكاليف في النموذج المستدام؟	16- How the CS will change as a result of sustainability movement? كيف ترى هذا العنصر الخاص بهيكل التكاليف في نموذج العمل سوف يتغير نتيجة التحول للنموذج المستدام؟
17- What are the SBMs elements affecting CS the most? ما هي العناصر المختلفة في النموذج التي ستؤثر اكثر في التحول للاستدامة؟	
C.9. Revenue Model هيكل الأرباح	
18- What is RM in SBMs? ما هي الأرباح المرجوة في نموذج الاعمال المستدامة؟	19- How the RM will change as a result of sustainability movement? كيف ترى هذا العنصر الخاص بالأرباح في نموذج العمل سوف يتغير نتيجة التحول للنموذج المستدام؟

D. Changes of Sustainable Business Model for the Saudi Arabian Housing Construction Industry **التحولات التي يجب عليها للوصول الى نماذج الاعمال المستدامة**
1- What are the changes needed for SBMs in the HCI and within the business environment now and in future? Please give details with examples? ما هي التغييرات التي تحتاجها نموذج العمل المستدام لكي يصبح فاعل التطبيق و مجدي اقتصاديا؟

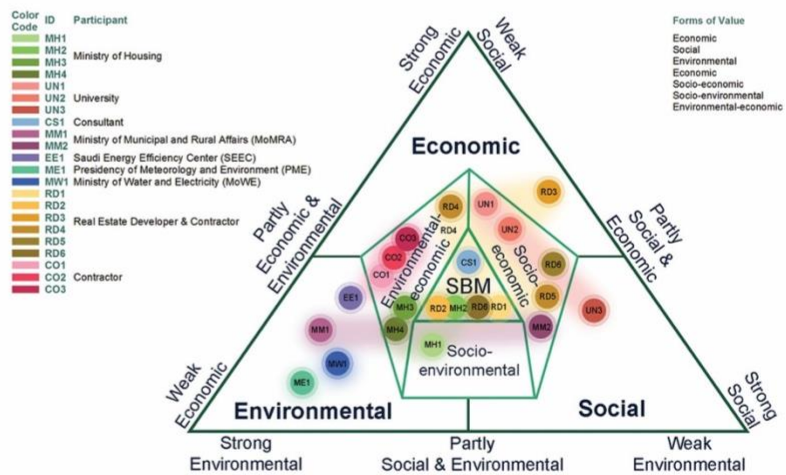
E. Benefits of Sustainable Business Model for the Saudi Arabian Housing Construction Industry **فوائد نموذج الاعمال المستدامة في قطاع الإسكان في المملكة العربية السعودية؟**
1- From experience what are the benefits of SBMs for the HCI now and in future? Any kind of benefits? Please list with examples? من خلال خبرتك ما هي الفوائد التي سيتم جنيها من خلال التحول للنموذج العمل المستدام؟ ارجو ذكر هدف تحقيق مع امثلة ان وجد؟

F. Challenge of Sustainable Business Model for the Saudi Arabian Housing Construction Industry **الصعاب او المشاكل التي تواجه تطبيق نماذج الاعمال المستدامة في قطاع الإسكان في السعودية**	
1- What are the challenges/ issues needed to be solve to realise SBM currently and in the near future? Inside the environment and outside? ما هي الصعاب التي تواجه تطبيق النماذج المستدامة حاليا في المستقبل القريب داخل نطاق الشركة او خارجها؟	2- How you will response to the challenge? كيف ستتغلب على هذه المشاكل؟

G. Summery الخلاصة
1- From the above question how would you develop a feasible SBM in the Saudi HCI? من خلال ما سبق هل تستطيع على تصميم نموذج عمل مستدام يثبت جدارته في قطاع الإسكان في السعودية؟

Appendix 6

Taxonomy Pattern for the SBM definition (triangle view)

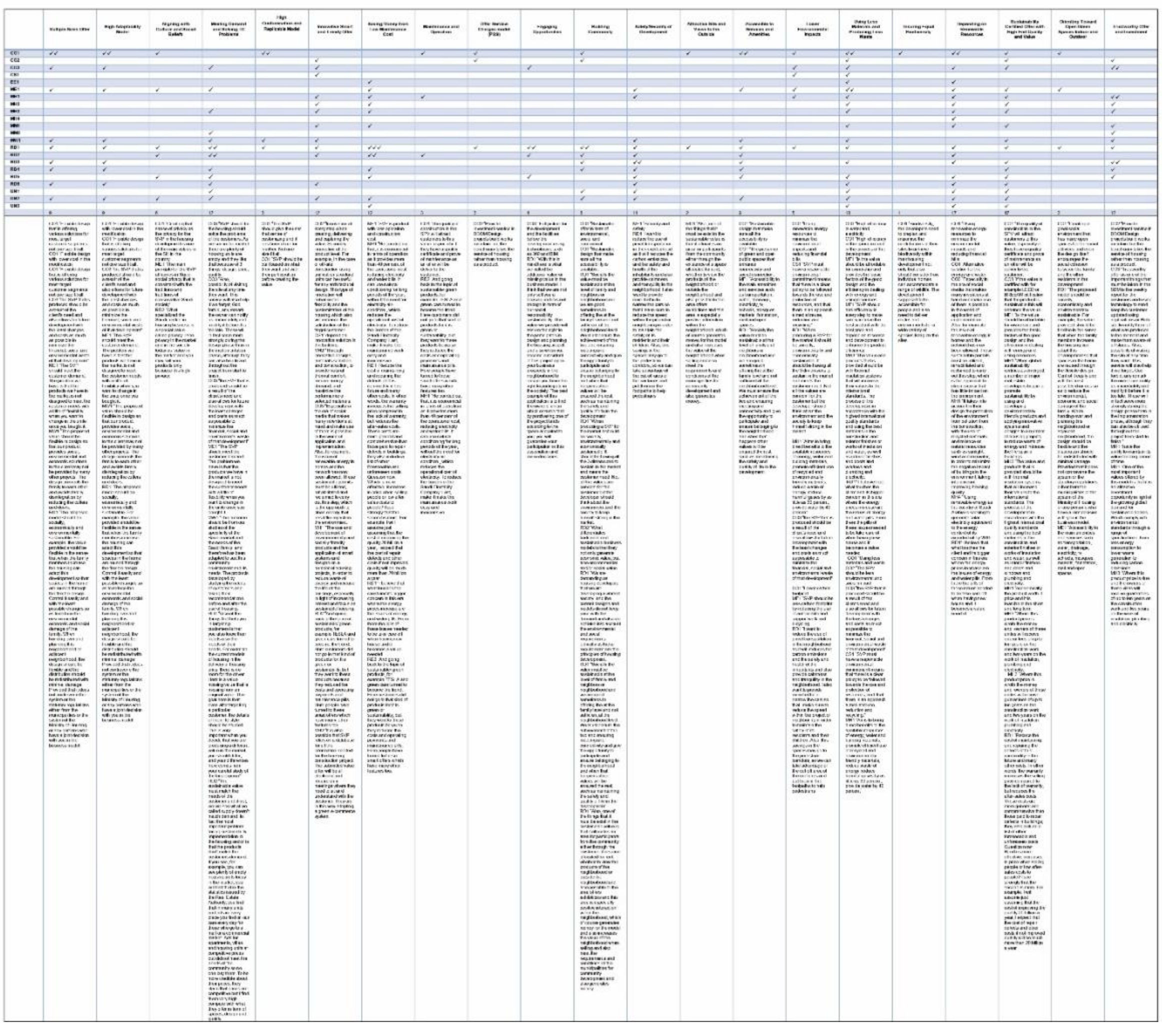


NO	Participant ID	Economic	Environmental	Social	Socioeconomic	Socio Environmental	Economical Environmental	Economical Environmental social
1	MH1		√	√		√√*		
3	MH2	√	√	√				√√√*
4	MH3	√	√				√√*	
2	MH4	√	√				√√*	
6	UN1	√		√	√√*			
7	UN2	√		√	√√*			
8	UN3			√*				
5	CS1	√	√	√				√√√*
10	MM1		√*					
9	MM2	√		√	√√*			
11	EE1		√*					
12	ME1		√*					
13	MW1		√*					
14	RD1	√	√	√				√√√*
18	RD2	√	√	√				√√√*
19	RD3	√*						
15	RD4	√	√				√√*	
16	RD5	√		√	√√*			
17	RD6	√	√	√				√√√*
20	CO1	√	√				√√*	
21	CO2	√	√				√√*	
22	CO3	√	√				√√*	

Appendix 7

Participant's Responses

Sustainable Business Model – Sustainable Value Proposition



Appendix 8

Participant's Responses

Sustainable Business Model – Customer Segments

		Environmentally Conscious	Sustainability Awareness	Customers looking for savings & comfort	Other sustainable value chain participants	Government Agencies	The owners of strategic projects	New Customers with different life-style sincere in their intentions, with a growing commitment to greener lifestyles	willing to take risk of going sustainable	Innovative, smart and trendy customers	Intelligent and Well-Educated	Customers	Non-governmental organizations NGOs
1	CO1	□	□			□	□			□	□		□
2	CO2	□	□	□					□	□			
3	CO3			□			□	□	□	□	□		
4	CS1	□	□					□					
5	EE1	□		□									
6	ME1			□	□					□		□	
7	MH1	□	□	□	□								
8	MH2	□	□	□	□	□					□	□	□
9	MH3	□		□	□				□	□		□	
10	MH4	□	□		□								
11	MM1	□	□	□	□	□	□	□		□			
12	MM2	□	□	□	□	□	□	□		□			
13	MW1	□		□	□					□	□		
14	RD1	□	□	□	□	□	□	□	□	□		□	□
15	RD2	□	□		□	□	□	□	□	□			
16	RD3	□	□	□		□	□	□	□	□	□		
17	RD4	□	□	□		□	□			□		□	
18	RD5	□	□	□							□		
19	RD6					□	□			□	□		
20	UN1	□	□	□	□	□	□	□	□	□		□	□
21	UN2	□	□	□							□		
22	UN3	□	□		□	□	□	□	□	□			
		20	16	16	12	11	11	9	8	8	8	6	4
		□ CO1 "and has the same sense and orientation towards the preservation of the earth. □ CO2 " the customers are environmentally Conscious and aware of sustainability. □ MW 1 "sustainability customers are different from traditional clients. They are people who are interested in the cleanliness of the environment, have acquired an environmental culture by traveling abroad and to know them, and our projects are rather inexpensive □	□ CO1" that is aware of the importance of the principles of social, environmental and economic development. □ MM2 "While the Saudis consumers are growing and aware of sustainability issues, the dominant model of consumption is still closer to – "if the burger tastes good I'll eat it", and "if the shirt looks good, I'll wear it". In fact, some of the greenest companies we admire are doing things that many of their customers know little to nothing about, not because their initiatives are not impressive, but because sustainability just doesn't figure into their core business model. □ RD1 "The change in the target customers should be choosing a sample of the community that is aware sustainability and its applications. So if you have any sample of people and worked for them to design and implement sustainable product with efficiency and all solar energy, but users do not value water and energy you will find that the model fail. □	□ ME1 "Sustainability customers are looking for reduced costs and the product offers comfort and well-being. □ CO2 "The look at sustainability from the perspective of saving and comfort as such model will provide economic, accessible, safe, comfort product. Going in a such model will get these offers. □ RD4 "Sustainable customers seek to reduce costs and provide the product with comfort and well-being. □	□ RD2 "One of the most important customer segment who are involved in creating sustainable value such as stakeholders and logistical support. All suppliers with the same business orientation towards sustainable business will be the ones who come to you with pioneering or strategic projects. □	□ CO1 "Clients of SVP may be from public and private universities as they know how is this model offering a new whole life-style and it will build environment, community and human. □ CO1 "The public sectors in the country puts sustainability of their responsibilities and put their activities in the forefront of their interests. □ CO1 "The public sectors of the state that give sustainability from responsibilities puts its activities first. □	□ CO1 "The owners of strategic projects in the state and have a special style and character shows how far the state has evolved and progress in the industrial, social and environmental development. □ RD2 "One of the most important customer segment who are involved in creating sustainable value such as stakeholders and logistical support. All suppliers with the same business orientation towards sustainable business will be the ones who come to you with pioneering or strategic projects.	□ RD1 "They are new consumer in the market and have specific requirements for the products they are buying. They look not only for the final product and the green certificate, they look and investigate your process of developing the product. □ From me " they don't expect organizations to be perfect in order to be considered 'sustainable'. Rather, they overlook for organizations that are taking essential process and have made a commitment to improve"	□ RD1 "While there are benefits attached to the sustainable and green products, but it still debated, the risks associated with its planning and production are increasingly apparent and rapidly evolving. There is a type of customers who are willing to take risk and pay for a product that has green certificate and jeopardizing their saving because they trusted sustainable/green products. □	□ RD2 "The customer of green products are now people who are financially capable. These people do not think about cutting electricity bills or cutting costs. First of all, they want to buy what is new or what is smart and a company that has a reputation and wants to buy its products. □ CO3 "the customer segments that value the product that is ready for future development with the least changes and costs as much as possible to minimize the financial, social and environmental waste of that development" □	□ CO1 "The Sustainable Model requires a customer that is well educated. □ MW1 "We target the educated customers regardless of their material situation because the educated class does not discuss prices very much, which is an enlightened segment that has an idea of the costs of construction and is driven by the luxury and durability of the product.	□ RD4 "Sustainability customers in the housing industry are the same as traditional home customers. Sustainable products are not an end value for themselves. What is important for them is to afford housing. □	□ CO1" Non-government organizations and organizations that do sustainability assessment as they seek this kind of development and targeting these people and establishing a relationship with them may increase the sustainable business modal activity, establish new relationships and open other projects. □

Appendix 9

Participant's Responses

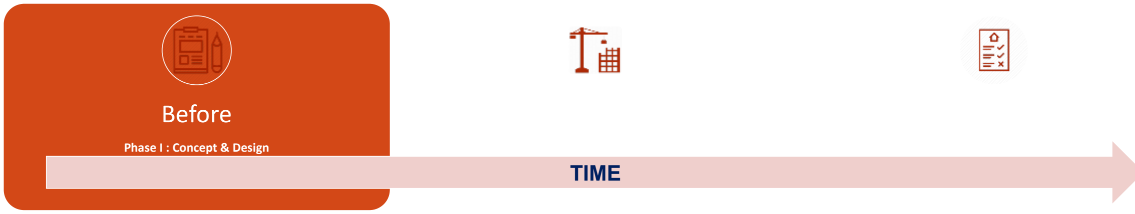
Sustainable Business Model - Channels

	Government	Green/ sustainable digital marketing	NGOs responsible for assessing sustainability	Green/Sustainable Exhibitions, Conferences and Roadshow	Dedicated sales teams with Green/Sustainable network	Green/ sustainable Social Medial	Community Marketing	Offices	Company Website	Personal Connection
CO1	✓			✓				✓		
CO2		✓							✓	
CO3						✓		✓		✓
CS1										
EE1										
ME1			✓							
MH1		✓	✓			✓				
MH2	✓	✓			✓					
MH3		✓			✓					
MH4										
MM1	✓									
MM2	✓									
MW1		✓		✓						
RD1	✓		✓		✓		✓			
RD2	✓		✓	✓						
RD3	✓	✓	✓	✓	✓					✓
RD4	✓					✓	✓			
RD5				✓						
RD6	✓		✓		✓					
UN1	✓	✓	✓	✓	✓	✓	✓		✓	
UN2		✓		✓						
UN3	✓		✓	✓						
	11	8	8	8	6	4	3	2	2	2
	RD6 " The ministries and governments offices will be our channel to reach sustainable projects as they will direct to us when having sustainable projects.	UN1 "For going green and sustainable digital marketing is now an important channel. As going digitalized will reduce the waste in materials and time. MW1 "Sustainable entrepreneurs are also using sustainable marketing methods. They are more dependent on digital marketing through social networking platforms and interact with them on a continuous way. CO2 "Company website, emails and sending catalogs	ME1 "Sustainability Assessors will undoubtedly be one of the important channels to support your business and marketing if your work model is sustainable.	CO1 "Attend exhibitions interested in sustainability, construction and real estate development and try to identify the target customers and their needs. Then, do architectural models of the developments with 360" virtual reality. That will the first step to get close to the target customer and establishing take their views and perceptions. RD5 "There is an excellent way for us as a developers called Roadshow where we book a hotel for two days and book a hall beside it and call our customers to the Roadshow and tell them that we are in the hotel and have a full team has architects, decorators, engineers and marketers. All this is just to give the prospectus customers a full idea about what we are serving and to make sure we answer all his questions and fears as well as meet his requests and wishes for the future home. Also, sometimes we call our old customers who have signed with us and ask them to make the corrections on the designs we made for them in the	UN1 "Another way to reach the customers by dedicating a team for marketing and this team should has a connection with green/ sustainable value chain. Where they can link their business model with your sustainable business model. They will be a channel for you as a part of their social responsibility.	MW1 "Sustainable entrepreneurs are also using sustainable marketing methods. They are more dependent on digital marketing through social networking platforms and interact with them on a continuous way.	RD1 "I am currently communicating with the target group through ((community marketing)) which I believe is the best marketing tool available in the market. - What do you mean by community marketing? I mean here from individual to individual or family to another family. Here is the idea that you are explaining your products to a person and that person if he is satisfied with what you have provided to him and becomes a marketer for you in his environment and the people he knows. There are 2 types of community marketing 1; organic where the company has no hand on it they advertise for you without you ask. 2; sponsored marketing where the company promote by doing some social activities for the community and then they connect with the prospectus customer.	CO1 "Also having an office that has an architectural model for the development in a special building on the site or anywhere near the development so that the future buyer can take a preliminary idea about the type of service we will provide and the quality we guarantee.	CO2 "Company website, emails and sending catalogs	RD3 "using personal connection with the owner of the green strategic projects in the country.

Appendix 10

Participant's Responses

Sustainable Business Model – Customer Relationship



	Customer Feedback	Market Awareness	Customer Interface	Sustainability Education	Conflict Center	Collaboration	Maintaining Sustainable Relationship	Trust	From Product Orientation to Customer Orientation
CO1		□	□	□			□		
CO2		□	□	□					
CO3		□				□			
CS1							□		
EE1									
ME1	□	□							
MH1	□				□				
MH2	□		□		□	□			
MH3					□				
MH4					□				
MM1									
MM2									
MW1	□	□		□					
RD1	□								
RD2	□ □ □	□	□			□		□	
RD3	□	□							
RD4									
RD5	□	□							
RD6									
UN1									
UN2	□	□		□					□
UN3	□	□						□	
	10	10	4	4	4	3	2	2	1
	□ ME1 "feedback strategies at the time of reviewing the design and before handling the key. Also, the same but after sales and transaction. □ RD2 "Not only taking the feedback also taking the lessons learned in every project we have done before. For example, when we were developing housing project we used to have 5 meters for the backyard and after reviewing the design with the target customer they advise us to put that 5 meter in the front yard as they will use it as a driver room. □ RD2 " Using feedback theory in the Customer Relationship element is a value added to the original BM to be SBM.	□ CO1 "In the SBM especially in R & D department the customer relationship is important as it maintain the relationship with target customer and treat them as internal capabilities. They support the model by telling what the problems are and needs and suggestions □ RD2 "Personally I think what differentiate traditional and sustainable business model is the level of taking the customer feedback and how the corporate in the model.	□ CO1 "In some cases for the innovation in SBM the start will be from this element by developing a Customer Interface where customers have the requirements and wants to convert to a dwelling. The company also should have flexible design unites that can suit any requirements by having construction building units ready not ready housing units. This ensures that this product during the production phase has not been a lot of waste of implementation as the construction was off site and will require a small number of workers only to install the house, which will not take more than a week or two maximum and maximum residues as well as carbon emissions and also without	□ CO1 "One of the most important tasks that we experience in the implementation sustainability in the business model is the awareness of the community about the importance of sustainability and its applications. Here comes the role of this element in the SBM where it will raise awareness in the community about the importance of applying sustainability in the housing production and what benefits they will gain from this application and this offer is supported by numbers and facts Which convince the beneficiary that the return is not only in the long run but also in the short term. □ MW1 "The relationship with customers is aimed at educating customers about the	□ MH2 "One of the things that SBM should take care of at the business level and at the country level is having a special department call (conflict center). This department is concerned with taking the views of consumers after handling the housing unite and finishing all the work. The customer after that will be asked about hi/her opinion and whether he/she took what was promised in the contract. Was the model working perfectly or there were problems? □ It is also the task of this center to establish guarantees for the housing unites both for construction and for the equipment.	□ MH2 " Collaboration in the planning and design phase with personal assistance. Designer will be setting with the prospectus customer to translate his pain and needs to a housing unite suit his/her need. □ RD2 "Personally I think what differentiate traditional and sustainable business model is the level of taking the customer feedback and how the corporate in the model.	□ CO1 "It is a very important element because it is the one that will sell all your products and is responsible on having strong relationships with consumers. □ CO1 "Which distinguishes this element in traditional and sustainable business model that relationship in the first is purely fiscal where it should exceed that level to have also social and environmental for the benefits of society and earth. □ RD4 "The SBM doesn't sell all the housing and lands. The model will generate infinity financial resources in the case of not selling everything. We do not terminate our relationship with the site during the	□ RD2 "In the SBM, there must be trust and confidence between you and the customer, which arises, of course, from the first meeting in distribution channel. It must be maintained and try to benefit from it as much as possible. □	□ UN2 "What is important in the SBM is to change from concentration on products and offers to develop products that are perfect for the target customers. The amount of waste generated in the first model is much higher compare to the second one.

Appendix 11

Participant's Responses

Sustainable Business Model – Value Configuration

	Assessment	Public and Customer Engagement	Follow the Principles of Sustainable Design and Production	Adopt Smart System Principles	Value Engineering	Adopting Building Code	Adopt Lifecycle Cost analysis to optimize sustainable production	Sustainability Training and Educating Workers	Review and Correct	Quality & Control check	Follow Government/Customers requirements and regulations	Embedded systems for Water, Materials and energy conservancy
CO1	▯	▯	▯	▯		▯	▯	▯	▯	▯	▯	▯
CO2	▯	▯	▯	▯		▯	▯	▯	▯	▯	▯	▯
CO3			▯	▯	▯		▯					
CS1	▯		▯	▯				▯		▯	▯	▯
EE1			▯	▯		▯	▯	▯		▯		▯
ME1			▯									▯
MH1	▯	▯	▯	▯	▯	▯	▯	▯		▯		▯
MH2	▯	▯	▯	▯	▯	▯	▯	▯	▯	▯		▯
MH3	▯	▯	▯	▯		▯	▯	▯		▯		▯
MH4	▯	▯	▯			▯	▯	▯		▯		▯
MM1	▯		▯	▯	▯	▯	▯			▯		▯
MM2	▯		▯			▯		▯				▯
MW1			▯	▯			▯ ▯		▯	▯		▯
RD1	▯	▯	▯	▯	▯	▯	▯	▯	▯	▯	▯ ▯	▯
RD2	▯	▯	▯	▯		▯	▯ ▯	▯	▯ ▯	▯	▯	▯
RD3	▯ ▯	▯	▯		▯		▯		▯	▯	▯	▯
RD4	▯	▯	▯	▯		▯		▯				▯
RD5	▯		▯	▯		▯	▯		▯	▯	▯	▯
RD6	▯	▯	▯	▯		▯	▯	▯			▯	▯
UN1	▯	▯	▯	▯	▯	▯	▯	▯	▯	▯	▯	▯
UN2	▯	▯	▯	▯		▯	▯	▯			▯	▯
UN3	▯	▯	▯		▯		▯	▯	▯	▯	▯	▯
	18	14	22	17	8	16	18	14	10	16	11	21
	▯ CO1 "As an important phase of the whole SBM the project, the developer, the project owner or the contractor must manage and assess every step and	▯ CO2 "What will change in the activities to be sustainable will start from the customer relationship where there will be relationship with the target group by	▯ CO2 "What will change in the activities to be sustainable will start from the customer relationship where there will be relationship with the target group by	▯ CO3 "One of the things that you may need in SBM is the adoption of intelligent systems or intelligent home systems that help in the conservation and non-waste of energy,	▯ CO3 "There is also a need for some studies related to finances, especially value engineering and life cycle cost for products and the calculation of the lowest value of		▯ MH1 "Through innovative designs, green materials selection and environmentally safe construction, to provide natural thermal comfort, reduce energy	▯ MH1 "Establishing works to increase the awareness of sustainability for its staff and reports internally and externally on the achievements of the carbon footprint	▯ MH2 "As well as supervising the work process continuously and correcting and confirming the integrity of the procedures and solving the	▯ MH2 "In the stages of key activities to do we have to do a control and quality of each stage where it must be done and monitored with the beneficiary in the monitoring of the	▯ RD1 "In the key activates also, planning and design must be based on the existing requirements and regulations of both customers and government. Do not intend to do anything without the existence of clear permissions and permissions, and to the	▯ CO1 "Adopting an integrated approach, especially in speeding decision making and also reducing costs by relying on standardized units and minimizing

Appendix 12

Participant's Responses

Appendix 13

Participant's Responses

Sustainable Business Model – Partnership Network

	With Public organizations and National Housing Program PPP	Manufactures of Equipment and Construction Materials /Suppliers	Similar Orientation Business	Investors	Real Estate Development Fund	Media	Bankers in Social Responsibility Program	Educational and Professional Institution	Real Estate General Authority	Non-Governmental Organization – Sustainability Assessors	Technology Partner	High Certified Contractors
CO1	✓	✓	✓				✓			✓		
CO2	✓	✓		✓		✓		✓		✓		
CO3	✓	✓	✓	✓	✓		✓		✓		✓	
CS1	✓	✓	✓		✓	✓	✓		✓	✓		
EE1	✓	✓	✓			✓		✓		✓		
ME1	✓			✓			✓	✓	✓		✓	
MH1	✓	✓	✓	✓	✓	✓			✓			
MH2	✓	✓	✓	✓	✓	✓			✓			
MH3	✓	✓	✓	✓	✓	✓			✓			
MH4	✓	✓	✓	✓	✓	✓			✓			
MM1	✓	✓										✓
MM2	✓	✓										✓
MW1	✓	✓	✓									
RD1	✓✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
RD2	✓✓	✓	✓	✓	✓	✓	✓	✓			✓	✓
RD3	✓	✓		✓	✓		✓	✓		✓		
RD4	✓	✓	✓	✓	✓		✓	✓			✓	✓
RD5		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
RD6	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
UN1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
UN2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
UN3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	21	21	17	16	15	14	13	12	11	11	11	7
	• RD1 " Partnership between the national housing programs and the private sector exists but there are problems in understanding this partnership. As the development of the residential project, the developer is forced to empty the services and facilities for the ministries to set up their projects, but the problem is that they do not do so at the start of the project. They do not have a budget for the work of the project, for example schools, mosques and health units. Or in some previous cases when no land is allocated for services and facilities. Then, the ministries search for lands within the plans and buy them at a high price and then the project is established. Does this make sense !!" • RD1 & 2 "In the case of partnership with the public sector, the state can trade the developer so that they develop and build mosques and schools in housing development and in return they give	• CO1 "Partnerships are very important element in the SBM as it reduces the cost structure of the original model. It is not possible to develop a housing project that is based on your current company BM only. This is also unreasonable. For example, if I did the precast concrete all I'll destroy the BM revenues and financial assets. There should a strategic partnership with the concrete and ready-made construction companies of Precast and concrete so that they develop and secure the concrete product whenever it is requested and at a price less than other because I guarantee a unified production line in a period not short and therefore the partnership will be built in a good relationship and not be instant. • RD1 "We need partnerships with suppliers such as the one produces automated building systems, such that these applications accelerate the process of implementation by more than 50% and	• CO1 "You need partnerships with other green / sustainable companies that are identical to you in orientation. • CO1 "Partnerships with clean energy companies will be one of the best partnership you will make in the housing development and this partnership should work from the initiation phase to ensure that the products are environmentally with all thermally insulation and energy saving fixtures. • CO1 "The partnerships are also important with green maintenance companies and the partnership with them since the stages of design may give you experience in materials and devices through their experience in maintenance and may give you butter expertise in the materials and guarantees and the best in the market. Especially as they will take over the installations in the operation and	• MH1&2 "3D Printing • RD1 " Automated Building System	• CO3 "it is great that we have in the market green and sustainable businesses they are so helpful. For example, if a company need for supports logistically, whether by employment, engineers or consultants as needed, and whether they are actually present or online support. Partnering with such business will enhance the model financially where also it will reduce the amount of money needed for the production.	RD5 "project. They do not have a budget for the work of the project, for example schools, mosques and health units. Or in some previous cases when no land is allocated for services and facilities. Then, the ministries search for lands within the plans and buy them at a high price and then the project is established. Does this make sense !!""	CO1 &RD1&RD3 "Partnerships with banks through their social participation for the support of sustainable development in the country and as a strategic partner that makes their participation in the community well-beloved and supported by consumers that is better through participation in society.	• RD1 "Universities here can enter into a partnership in this sustainable business model, either by providing their expertise or by training qualified students and researchers specializing in sustainability. Also, by advising our model in building development in their site.	RD3 "Partnerships with banks through their social participation for the support of sustainable development in the country and as a strategic partner that makes their community well-beloved and supported by consumers that is better through participation in society.	• RD1 " I imagine if we have sustainability assessors or an organization in the country where the assess and evaluate the sustainable project and give them rate rather than the international one I mean one for this country. Partnership with such organization will enhance the work for the company also the assessors will work as a marketing channel for you where they will promote and advertise for your excellent work but that will need strategic partnerships with clear controls.	• CO3 "it is great that we have in the market green and sustainable businesses they are so helpful. For example, if a company need for supports logistically, whether by employment, engineers or consultants as needed, and whether they are actually present or online support. Partnering with such business will enhance the model financially where also it will reduce the amount of money needed for the production. •	• RD6 " employment, engineers or consultants as needed, and whether they are actually present or online support. Partnering with such business will enhance the model financially where also it will reduce the amount of money needed for the production.

Appendix 14

Participant's Responses

Sustainable Business Model – Cost of Structure

	Media and Marketing Cost	Research & Development Cost	Sustainable Certificate Cost	Technological Support Cost	Cost of Machineries and Materials	Environmental Impact Relief Costs	Cost of Infrastructure Maintenance	Training Courses Cost	Cost of Facilities	Cost of Distribution and Transportation	Customer Service Platform & Interface Cost
CO1	✓				✓		✓				
CO2	✓	✓	✓		✓	✓				✓	
CO3	✓	✓	✓	✓		✓		✓			✓
CS1		✓		✓		✓		✓		✓	
EE1		✓		✓	✓		✓		✓		
ME1	✓	✓	✓	✓				✓		✓	
MH1	✓		✓		✓		✓		✓		✓
MH2	✓	✓	✓		✓		✓		✓		✓
MH3	✓	✓	✓	✓	✓		✓	✓	✓		✓
MH4	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
MM1					✓	✓	✓		✓	✓	
MM2					✓	✓	✓		✓	✓	
MW1	✓	✓	✓		✓	✓	✓		✓	✓	
RD1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
RD2	✓	✓	✓	✓	✓	✓	✓	✓	✓		
RD3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
RD4	✓	✓	✓	✓				✓		✓	
RD5	✓	✓	✓	✓	✓	✓	✓	✓			✓
RD6	✓	✓	✓	✓		✓		✓		✓	
UN1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
UN2	✓	✓	✓	✓		✓		✓		✓	
UN3	✓	✓	✓	✓	✓	✓	✓	✓	✓		
	18	18	17	16	16	15	15	14	13	12	9
	• CO1 "But to keep them for the fourth quarter which will be for marketing as they are campaigning for our products and also organize models and attend exhibitions to display, sell and rent our products. • CO3 "There is no doubt that in SBM if you want to develop yourself and be on track for the future you should invest and put some amount of money from the revenue in R&D because these are the ones who will support the company in case of risks. •	• CO3 "There is no doubt that in SBM if you want to develop yourself and be on track for the future you should invest and put some amount of money from the revenue in R&D because these are the ones who will support the company in case of risks. •	• RD6 "employment, engineers or consultants as needed, and whether they are actually present or online support. Partnering with such business will enhance the model financially where also it will reduce the amount of money needed for the production.	• RD4 "Conventional business model projects differ from sustainable in that the use of different technologies will be widespread if sustainable modeling is adopted. In the outputs of this model, such as sustainable projects, we will have a reduction in the costs of normal operations from construction and supply of materials and labor. There will be an increase in the costs of technical support, research and development, studies and design. •	• MW1 "The most heavy costs that require money in the model are infrastructure, construction, electricity and sewage, as they consume more than half of the cost •	• CO2 "When we talk and display sustainable products as a summary of our sustainable business model we mean here the product is sustainable in every step that has been gone through. The design, process of production, maintenance, efficiency and operation. This will come absolutely at a price. There will be extra prices on the materials used for this product but with time this amount of money is payable for the quality and the environment. • MW1 "The factors that affect the cost structure are the local supply. Local construction prices are expensive. Thus, the thought of importing needs time to transport and supply. It also represents a financial burden on companies. The lack of local companies producing sustainable building materials and providing sustainable services to real estate developers is in itself a problem added to the cost structure of sustainable projects as we are forced to import these materials from abroad •	• MW1 "The heaviest costs that require money in the model are infrastructure, construction, electricity and sewage, as they consume more than half of the cost	MW1 "The factors that affect the cost structure are the local supply. Local construction prices are expensive. Thus, the thought of importing needs time to transport and supply. It also represents a financial burden on companies.	MW1 " Supporting green facilities construction, electricity and sewage, as they consume more than half of the cost	MW1 "The factors that affect the cost structure are the local supply. Local construction prices are expensive. Thus, the thought of importing needs time to transport and supply. It also represents a financial burden on companies. • CO3 "There is no doubt that in SBM if you want to develop yourself and be on track for the future you should invest and put some amount of money from the revenue in R&D because these are the ones who will support the company in case of risks.	• RD4 "Conventional business model projects differ from sustainable in that the use of different technologies will be widespread if sustainable modeling is adopted. In the outputs of this model, such as sustainable projects, we will have a reduction in the costs of normal operations from construction and supply of materials and labor. There will be an increase in the costs of technical support, research and development, studies and design. • CO3 "There is no doubt that in SBM if you want to develop yourself and be on track for the future you should invest and put some amount of money from the revenue in R&D because these are the ones who will support the company in case of risks.

Appendix 15

Participant's Responses

Sustainable Business Model – Revenue Model

	Government Compensation	Socio Environmental Revenue	Return from Savings	Green Loans	Alternatives Revenues	Alternatives Paying Methods	Adding Service to the Products Revenues	How to Source from Surplus Materials, Design	Hosting Workshops/ Courses/ Consultancy
CO1	✓	✓	✓	✓					
CO2	✓	✓	✓	✓	✓				
CO3	✓			✓	✓	✓	✓		✓
CS1	✓	✓	✓	✓	✓				
EE1	✓	✓	✓						
ME1	✓	✓	✓	✓	✓		✓		
MH1	✓	✓	✓	✓		✓		✓	
MH2	✓	✓	✓	✓		✓		✓	
MH3	✓	✓	✓	✓		✓		✓	
MH4	✓	✓	✓	✓	✓	✓	✓	✓	✓
MM1	✓	✓	✓			✓		✓	
MM2	✓	✓	✓			✓		✓	
MW1	✓	✓	✓						
RD1	✓	✓	✓	✓	✓	✓	✓	✓	
RD2	✓	✓	✓	✓	✓	✓	✓		✓
RD3	✓	✓	✓		✓	✓		✓	
RD4	✓	✓	✓		✓		✓		
RD5	✓	✓	✓	✓	✓	✓	✓		
RD6	✓	✓	✓		✓		✓		
UN1	✓	✓	✓	✓	✓	✓		✓	✓
UN2	✓						✓		✓
UN3	✓	✓	✓	✓	✓	✓	✓		✓
	22	20	20	14	13	13	10	9	6
	•CO1 "There will be support from the public sectors in the state that take sustainability from their responsibilities and put their activities first and the support might be a sort of grants or sometimes logistics support. •CS1 "Just as the government has taken a positive approach in 2016 towards formulating a sustainable vision for the future of the national economy, which involves bringing together ministries to work together, it is time for companies and their leaders to bring together their teams and constituencies towards comprehensive and sustainable development aimed at securing their future. As they reported they will support sustainable business and any business support the goals of sustainable development. •	•MM1 "For sustainability in business modeling, including sustainability and green architecture, returns are environmental, support the principle of life quality and provide services to the development such as green spaces, playground facilities, parks and places for people to gather and communicate. This I think is a real sustainability. •RD1 "Also in the SBM revenue is not only physical but social, so that it is a vital, safe society and a decent quality of life with a flexible design that accepts family changes with minimal damage. As well as environmental revenues summarized in the conservation of natural resources and reduce environmental waste and also maintain and reduce the prices of energy and electricity used in the project. •	•RD1 "In terms of changing to the sustainable model, there will be returns from the stages of value creation, for example returns from the solar energy built in the project. There are returns from the services and utilities in the project or returns through the use of less expensive recycling materials and these are infinite income. •RD3 "By investing in the company's technical resources and implementing value engineering for residential units as well as life cycle cost, there will of course savings in the money spent on residential units. This money should be pumped back to the revenue model. •CO2 "Saving form using recyclable materials •	•CO1 "There will be support from institutions and non-governmental organizations as green loans, particularly those related to sustainability assessment, as they are looking for this kind of sustainable development. This support should be placed in the revenue structure	•CO3 "I think it is assumed in the SBM that it has sustainable and alternatives revenue rather than a single revenue. For example, in developing a large housing development project we are giving up our financial rights for the design price in return we have the right to own property in the project as well as investment.	•CO3 "For sustainable business modeling, I think it is necessary to give the customer more than one method of payment. So that it will not be only becoming product delivery for a material return. It is possible to pay in other ways or to be paid by a monthly amount or by any method that is easy for either the organization or the customer because the lower the cost of course there will be a reduction in the cost and thus the client will benefit from this shortage and will be able to compete in the market and strongly.	•ME1 " For example, real estate developer redevelop the raw land, build on it and resell it. This is a source of profit for companies and if you want a sustainable source that develops in the product to become a service provider instead of the products and benefit from maintenance costs and thus provide a source of continuous income.	• CO3 "There is no doubt that in SBM if you want to develop yourself and be on track for the future you should invest and put some amount of money from the revenue in R&D because these are the ones who will support the company in case of risks.	•CO3 "I also think through the R&D and innovation part we can generate a new source of income not found in the traditional business model. For example, income will be money in exchange for courses or consulting for emerging companies. •

Appendix 16

ISM Framework Focus Group 1

Focus Group 1 Sample

Participant's ID ___ __ - __ __ __

City and Cod __ __ ____ __ ____ __ __- __ __

Date of Gathring __ __ __ __ __ __
DD MM YY

Initials of Interviewer _____ (minimum of 2 letters)

To be completed at time of data entry:

Date of data entry __ __ __ __ __ __
DD MM YY

Initials of data entry staff _____

Background and Demographic

Type of organization

Job title

Years of experiences

Size of the company

Education level

ISSM SBM Questionnaire

First Section: The SBM Elements Relationships:

The study focuses at this stage in studying the relationship between the elements of the Sustainable Business model for the Saudi Housing Construction Industry. To go on with this study, we appreciate if you could fill in the next questionnaire. It takes only a few minutes.

V - variable i will help to achieve variable j

A - variable J will help to achieve variable i

X - variable i and J will help to achieve each other

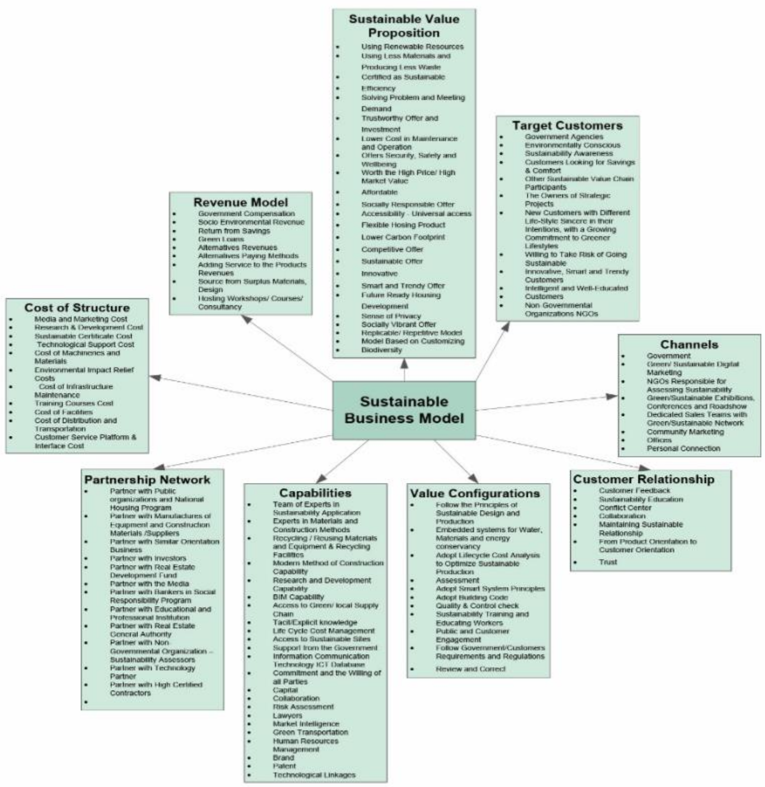
O - variable i and J are unrelated variable

- **Sustainable Value Proposition**: Describing the bundle of sustainable products/services that create value for a specific customer segment
- **Target Customer Segments**: Definition of the different groups or organizations a company/enterprise aims to reach and serve
- **Distribution Channels**: Describing how a company communicates with and reaches its customer segments to deliver its value propositions
- **Customer Relationships**: Describing the types of relationships a company establishes with specific customers
- **Value Configurations/ Key Activities**: Describing activities performed in the company to make its business model work
- **Core Capabilities/ Key Resources**: Describing the most important assets required to make a business model work
- **Partner Network**: Describing the network of suppliers and partners that make a business model work

- **Cost of Structure**: Describing all the costs incurred to operate a business model

- **Revenue Stream:** Describing the cash a company generates from each customer segment. (Revenue – costs = earnings/profits)

		1	2	3	4	5	6	7	8	9
		Sustainable Value Proposition (SVP)	Target Customer (TC)	Distribution Channels (DC)	Customer Relationships (CR)	Value Configuration on key activities - (VC)	Key Resources (KR)	Partner Networks (PN)	Cost Structure (CS)	Revenue Model (RM)
1	Sustainable Value Proposition (SVP)	x								
2	Target Customer (TC)		x							
3	Distribution Channels (DC)			x						
4	Customer Relationships (CR)				x					
5	Value Configuration key activities - (VC)					x				
6	Key Resources (KR)						x			
7	Partner Networks (PN)							x		
8	Cost Structure (CS)								x	
9	Revenue Model (RM)									x

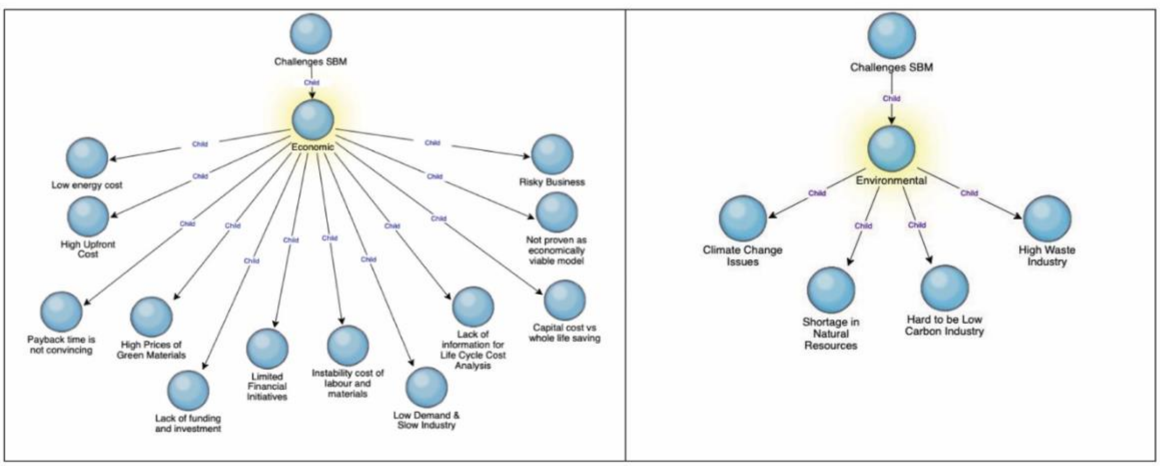


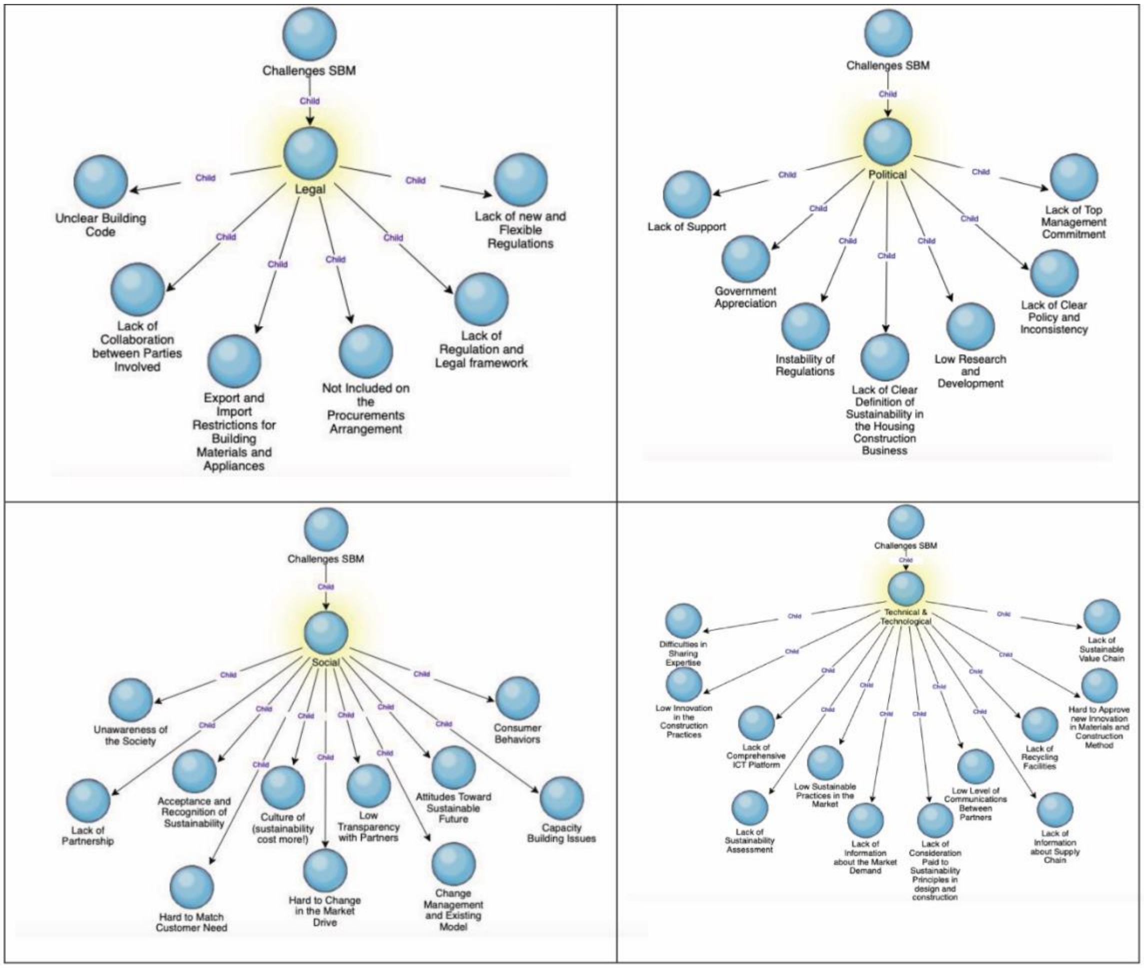
Second Section: The Implementation Guideline

From Above Elements could you please drew an implementation plan (Guideline for the Implementation)

Third Section: The Implementation Challenges for the SBM

No	Type of Challenges	Description
1	Political	Policy coverage and regulations at all levels. Areas such as global environmental agreements, from proposal to acceptance and its implementation at grassroots. Covers implications at different levels of planning such as municipal level, organisational planning level, community planning level etc.
2	Economic	Describes the issues associated with regional, national or global economy on a macroeconomic level which can lead to a decline in factors of production or affect policymaking at an organisational level during SBM transformations.
3	Socio-Cultural	Includes subjects involving sharing of beliefs, attitudes of the population and marketing management knowledge about consumers and its understanding.
4	Technological / Technical	Includes areas such as methods of production, provisioning of services, distribution, and communication with target markets.
5	Environmental	Describes the present issues in the environment, the impact of companies on the environment at micro and macro levels. Covers a broad spectrum of issues relating to the environment and presents a presentation of firms that are environment-friendly.
6	Legal	Includes areas such as related to legal implications and how legislation driven by other factors (political, environmental, socio-cultural, economic) affects business strategy and SBM transformations.





From the Above definition and the figures 1-1 till 1-6 mark the relationship symbol

		1	2	3	4	5	6
		Economic	Environmental	Legal	Political	Social	Technical/ Technological
1	Economic	X					
2	Environmental		X				
3	Legal			X			
4	Political				X		
5	Social					X	
6	Technical/ Technological						X

Appendix 17

ISM Sustainable Business Models Framework Validation Focus Group 2

Focus Group 2 Validation

Participant's ID ___ - _ _ _

City and Cod _ _ ___ _ ___ _ _- _ _

Date of Collection _ _ _ _ _ _
DD MM YY

Initials of Interviewer _____ (minimum of 2 letters)

To be completed at time of data entry:
Date of data entry _ _ _ _ _ _ (DD MM YY)
Initials of data entry staff _____

The SBMs Framework Questionnaire

First Section: The SBMs Framework:

The study focuses at this stage in validating the outcomes of the studying the relationship between the elements of the Sustainable Business model for the Saudi Housing Construction Industry, challenges associated with the implementation and the final guidelines. To go on with this study, we appreciate if you could fill in the next questions. It takes only a few minutes.

- **Sustainable Value Proposition**: Describing the bundle of sustainable products/services that create value for a specific customer segment
- **Target Customer Segments**: Definition of the different groups or organizations a company/enterprise aims to reach and serve
- **Distribution Channels**: Describing how a company communicates with and reaches its customer segments to deliver its value propositions
- **Customer Relationships**: Describing the types of relationships a company establishes with specific customers
- **Value Configurations/ Key Activities**: Describing activities performed in the company to make its business model work
- **Core Capabilities/ Key Resources**: Describing the most important assets required to make a business model work
- **Partner Network**: Describing the network of suppliers and partners that make a business model work
- **Cost of Structure**: Describing all the costs incurred to operate a business model
- **Revenue Stream:** Describing the cash a company generates from each customer segment. (Revenue – costs = earnings/profits)

Q1: Does the final framework reflect the right interaction between the SBMs elements? If not, would you please suggest how this can be done?

Q2: Out of your experience, do you think this framework reflect a right image of SBMs in the Saudi housing construction industry? If not, please could you add any suggest for the enhancement?

Second Section: The Implementation Guideline

Q3: Do you see the guideline has been made for the implementation clear and easy to be understand? Do you suggest any reorder? see it useful for the housing construction industry and more specifically for the housing developers and the housing construction companies?

Third Section: The Implementation Challenges for the SBM

Q4: Does the final challenges associated with the SBMs framework development reflect the right interaction between the SBMs challenges? If not, would you please suggest how this can be done?

Third Section: Summery

Q5: Do you have any suggestion for the enhancement?