



CHALMERS
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Adopting a business model perspective for sustainable building

A literature and case study

Master's Thesis in the Master's Programme Design and Construction Project Management

VASUDEV BADI

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Göteborg, Sweden 2018

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ABSTRACT

The importance to sustainability in building sector become important mostly because of more energy consumption and usage of resources in construction of buildings. Business models with proper key elements for sustainable buildings has the capability to reduce the negative impact on environment and raise the economic and environmental benefits. But there are many challenges in order to achieve goals, for this a wide research is necessary on both business models and sustainable buildings.

Therefore, the aim of the thesis is to investigate business models, sustainable buildings and subtopics related to these tasks and develop a new business model for sustainable buildings with considering different views from both literature and case studies.

In order to achieve, a qualitative method with an inductive approach is used to conduct the study. For this, two research methods are used in the process. Firstly, a literature review has been done on following topics such as business models, business model innovation, sustainable buildings and sustainable development. Secondly, from the case study research four case studies are selected and divided into two types those are individual buildings and companies. From the literature and case studies key elements are identified and designed a new business model.

The new business model has four main elements: sustainability, innovation, networking and value proposition, and sub elements are: energy efficiency methods and environmental care; design, IT support & tools, and innovative architecture; key stakeholder identification and customer and employee satisfaction; and newness. Sustainable buildings with economic gains are challenging to achieve. However, sustainable buildings add value to the society and economic benefits can be achieved in the long-run. This new business model can be basic guideline for start-ups, small scale companies and for future research.

Key words: Business models, business model innovation, sustainability and sustainable development, sustainable construction and sustainable buildings

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Preface

This master thesis is the final task of the master programme in Design and Construction Project Management at Chalmers University of Technology. This thesis has been done at the Division of Service Management and Logistics.

To study about business models, sustainable buildings and its key elements is important for the construction of sustainable buildings in the future.

I would like to thank my examiner and supervisor, Pernilla Gluch for the support and guidance during the progress of the report and special thanks to Daniella Petersen, PhD student at Division of Service Management and Logistics for valuable advice and feedback. I also appreciate my peer-reviewers for useful comments and suggestions.

Lastly, I would like to dedicate this master thesis to my friends, family and University for their support and love.

Göteborg, February 2018

Vasudev Badi

Abbreviation

CO2	Carbon dioxide
BMfS	Business model for sustainability
GHG	Greenhouse gases
BIM	Building Information Modelling

1 Introduction

This thesis investigates business models in relation to sustainable buildings, and provides basic research on business models and also regarding sustainable development and innovation. This chapter contains background introducing the problem and concepts involved in thesis followed by aim and objectives and research question.

1.1 Background

In this modern world, there is an increasing demand for buildings which leads to higher resource consumption. According to Winston (2009), in the construction field, buildings consume more energy and resources compared to other sectors in this field, such as roads and bridges, etc. Construction sector consumes a high amount of different valuable resources such as wood, water, minerals and energy, these resources can be reduced by proper design of buildings and by managing resources. The importance to move building and construction industry towards sustainability is pointed out by different authors in many publications and research has shown in figures that construction industry consumes 40% of global energy and waste generation and 50% of CO₂ emissions (Trinius, 2007).

Currently, buildings with an outspoken sustainability profile are only constituting a small proportion of the construction market, in both developed and developing countries. The construction industry and companies has recorded only a few number of sustainable buildings with valid energy performance data and required elements in this area (Zhao and Pan, 2015). However, there are few resources such as case studies, literature which contains the key elements and business perspectives for sustainable buildings. Moreover, the effect of the business plan on the delivery of sustainable buildings is still unclear. There is lack of research on important elements required for constructing sustainable buildings from the business side. This thesis helps to identify key business elements based on research. Identification of these key elements and its application in business model can be the solution to address the issue of sustainable building to a greater extent than today. The thesis adopts the following definition on business models for sustainability as defined by Schaltegger et al. (2016, p. 6):

“A business model for sustainability helps describing, analyzing, managing and communicating 1) a company’s sustainable value proposition to its customers, and all other stakeholders, 2) how it creates and delivers this value, 3) and how it captures economic value while maintaining or regenerating natural, social, and economic capital beyond its organizational boundaries”.

Sustainable building is defined as “*building with a minimum environmental impact*” (Priemus, 2005, p. 6). From literature studies, it is concluded that in sustainable

buildings, the primary focus is on environmental sustainability (Kibert, 2016). Since the building industry is the major consumers of resources and also it is one of the major producers of pollution, the thesis is focused on the environmental point of view.

1.2 Aim and objectives

The aim of the thesis is to investigate business models and sustainable buildings and develop a business model for sustainable buildings. To achieve the aim differences between a number of chosen case companies is compared to theory. Furthermore, a business model including key elements that encompass sustainable building is designed. The relationship between key elements or individual analysis of different elements is out of scope for the thesis.

The objective of the business model analysis is to identify the key elements, business systems and to review the concepts involved with business models. The result of the thesis can be used as a guideline for practitioners and researchers to identify the important elements required while adopting an efficient business model for sustainable buildings.

1.3 Research question

What are the key elements required to build sustainable buildings by adopting a business model perspective?

2 Methodology

This chapter begins with the introduction of the research process, which follows inductive method. The research strategy is then explained by supporting the nature of the study, which is developed by the theoretical framework and case studies. Systematic literature review and Case studies are used as research methods.

2.1 Research approach

In this part how the research is approached and about different methods chosen in the thesis process is discussed. Firstly, a literature review has been conducted in the following areas: business models, sustainable development, sustainable buildings and innovation. This process is done by desk research. Secondly, in order to find case studies different company websites and corporate sustainability reports were reviewed. These methods are chosen and explained with respect to aim and objectives of the thesis. This combined approach is selected because it develops a good understanding of the topic and a good basis to formulate the problem related to the adoption of business model perspective for sustainable building.

This research process can be emphasized as qualitative approach, whereas a *“qualitative approach is to inquiry, the collection of data in a natural setting sensitive to the people and places under study, and data analysis that is inductive and establishes patterns or themes The final thesis report or presentation includes reflexivity of the researcher, and a complex description and interpretation of the problem, and it extends the literature or signals a call for action”* (Creswell and Poth 2017, p. 8).

The research is conducted with an inductive approach. Inductive research involves the theory that is developed in a ‘data-driven manner’ by using qualitative data. In this, the theory is understood as a different set of statements linking the main concepts in theory to one another (Bryman and Bell, 2015). Whereas Woo et al. (2017) argued that inductive research begin with a clear purpose and possibly with a research question where the study is designed to answer. Even in this thesis, it started with a research question and later theory is developed based on the findings, aim, and objectives. Table 1 presents the structure of the thesis.

Table 2.1 Structure of the thesis.

Structure of the thesis	
Introduction	Introduction about the thesis, it includes Aim & Objectives, and Research question.
Theoretical framework	The theoretical framework is done by Literature review which contains Business models, Sustainable Development, Sustainable buildings and Innovation.
Methodology	The thesis process is done by using methods Literature review and Case study approach.
Results and Findings	There are four case study results divided into two types
Analysis and discussion Conclusion	Analysis and discussion is done based on proposed business model and conclusion

2.2 Literature review

The literature review provided information about business models, business model innovation, sustainability, concepts of sustainability and sustainable building. These topics were studied to analyze and create a strong foundation for the case studies. The literature review also provides the support to build the research design and to justify the research questions. It also informs how the data is collected and enables to analyses the data in a knowledgeable method (Bryman and Bell, 2015).

The literature review is done in three steps. The steps are presented in figure 1. The literature search was done using the following academic databases: Scopus, ProQuest, Science direct, Google scholar, SAGE Journals, EBSCO Host. Firstly, the literature search is done with different keywords such as business models, business models elements, business model innovation, sustainable development, and sustainable buildings. Then the relation between business models and sustainable development is studied. In the mean while different key elements required for business models for sustainable buildings are identified from the literature review. This formal basis will be the guideline to compare with case study elements.

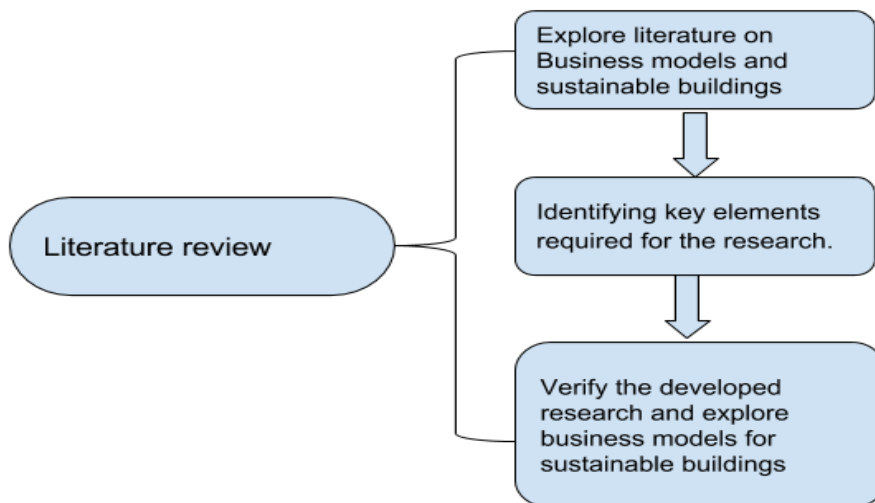


Figure 2.1 - Literature review steps.

2.3 Selection of cases

Case study research is a methodology in qualitative research where the researcher explores a case or multiple cases in the process, through detailed information, collection of in-depth data involving various sources of information (e.g. observations, interviews, reports, documents, audio or visual material) and address a case description (Creswell and Poth, 2017). Case study research provides a mechanism where several qualitative methods can be combined, by that avoiding of dependence on a single approach (Bryman and Bell, 2015).

The study focused on companies and individual buildings which have shown significant results in the energy sector, economically feasible, sustainable and in value creation and also which has the capability for systematic change by considering environment or sustainability as the main factor.

The websites, annual reports, and other organizational documents are reviewed to select case studies that are involved in sustainable buildings or sustainable companies. Different business models are studied in order to find sustainability as a major part of their business models. The case studies are divided into two types one is companies and other is individual buildings because the chosen topic is focused on both business models and sustainable buildings.

The criteria for selection of cases from different backgrounds is to obtain a diverse knowledge, clearer view and for better understanding. The cases are selected on the view of high performance and supported with energy efficient designs in the buildings. The companies are selected on the basis of sustainability as the major element in the company. The companies shown significant results in achieving sustainability and

which gave importance to solve issues and applied sustainable measures in this field are selected.

There are different issues in selection of case studies. There are only few case studies with business model elements and necessary information with respect to research of the thesis. Most of the research is done through desk research without consulting companies and owners of buildings due to time constraints and language issues.

Firstly, White Arkitekter and Ramboll companies were chosen for the research study because they, in terms of sustainability, are some of the leading consultancy companies in Scandinavia. These companies' business models are analyzed in order to find the key elements for sustainability and in a business perspective. Secondly, two individual case studies are Little Greenie project and Bullitt Center are selected, these are used in the research study on the basis of some of the sustainable buildings that promote value and sustainability. The key elements are identified from the individual sustainable buildings. The key elements are taken from the case studies and finally designed a new business model with respect to theoretical framework.

3 Theoretical Framework

This chapter contains theoretical framework based on literature review. A literature review has also been taken in this thesis processes for better understanding of business models and key elements for sustainable buildings. The chapter begins with the introduction of business models and its concepts then continued sustainable development and its subtopics. The key elements are identified from the literature review and are concluded at the end of this chapter.

3.1 Business models

The business model concept provides a holistic view of how companies do business, this is why the business model concept has been widely used in recent years (Brege et al. 2014). In the present world, there is need of new business models in the construction field for being more sustainable and also for creating more employment. Whereas, Winston (2009) argued that traditional business models are not satisfactory for sustainable buildings (buildings, houses, offices) (Winston, 2009).

“Creating a business model is, then, a lot like writing a new story” (Magretta 2002, p. 4).

The term business model has been used widely in recent years, practitioners and researchers have shown much interest and given ample attention to business models. However, surprisingly, the business model concept is not well defined in the literature (Zott et al. 2011). Nevertheless companies build, define and innovate business models in their own way from the beginning of the business. Companies not only differ in products, they also differ in selling, interaction with stakeholders, and also in the internal business systems. Unique technologies, better education, globalization, sustainability factors, value-added processes et cetera, create new opportunities for business development (Slavik, 2014).

A business model concept presents the link between the individual firm and the production system in which they are going to be involved in the future (Boons, 2013). In addition, the business model concept provides the company’s picture how it generates revenues and profits (Yunus, 2010). While Shafer (2005) describes a business model as a firm’s idea or logic and strategy to create and capture the value within the process of the value network.

Morris et al. (2005) refer business model as a *“the design of key interdependent systems that create and sustain a competitive business”* (p. 727). Likewise, Zott (2010) describes a business model as a value creation system for all the parties involved in the system, it designs or plans for different firms involved in the value creation and represents as a co-defining value capture, which raises the value potential of a firm. In the same way, a business model provides a vision of how a firm organizes by itself to create and distribute the value in a profitable manner (Baden fuller, 2010). In order to

meet environmental challenges, understanding business models and its implications are necessary to organize the business and its processes and also when understanding and identifying what key elements are required to achieve goals easily.

Business models are also represented in the form of elements, i.e. elements describing what a business model contains. The elements are also mentioned in different terms such as building blocks, components, key questions or functions. Sometimes business models elements are shown as part of the definitions and other times labeled as frameworks, ontologies or separate lists (Fielt, 2013). Many authors (Teece, 2010; Morris et al. 2005; Amit and Zott, 2001) has conducted literature reviews to identify the definitions and insights of the business models and to identify the key elements. Osterwalder and Pigneur (2010) presented the framework business model canvas, it is widely used and well-known. The business model canvas is a tool that can be used for describing, analyzing and designing business models. It is a guide to generate and design innovative business models together including concepts, techniques, and tools. Osterwalder's business model canvas is the follow up of Osterwalder's business model ontology (Osterwalder, 2010).

Although there are many different views and types of elements used in business models, in this thesis the elements are identified and compared with case study elements to analyze important elements required for the business models to deliver sustainable buildings. In this way, business model elements can be used to answer questions what are the key elements required to create sustainable buildings by using business models in an innovative way. The definition used in the thesis is, according to Osterwalder (2005) a business model is a concept to express the business philosophy of an organization which contains a set of objects, concepts and their relationships to represent and describe what kind of value is delivered to customers and how it is delivered with financial importance.

3.1.1 Business model innovation

After many consequences of non-sustainability issues around the world, there is a rapid increase in sustainable innovation. The sustainability challenges are transformed as ideas for creating business opportunities in the business communities and new markets are establishing. Similarly, Chesbrough (2010) considers that innovation in services makes businesses grow with the clear and in sustainable way and solve the issues related to growing pressures from commoditization of products. Also a large amount of capital flowing into these sustainable innovations (Boons, 2013a). Boons (2013b) review shows that the topic innovation also plays a key role in the literature of business models.

The business model innovation in literature generally stated as changing the value proposition of customer. On the other hand, it is more than changing the product and services for the customer; business model innovation includes changing 'the way you do business' rather than 'what you do' and therefore must go beyond process and products (Bocken, 2013). While Yunus (2010) defines business model innovation as a new way of generating profits and new value to the customers. Shafer (2005) argue that business model facilitates analysis, testing and validation of a firm's strategic choices,

it is not a strategy. On the other hand Business model innovations for sustainability are defined as: innovations that generate positive or reduced negative impacts on the society and/or environment through changing the way the organization and its value creation network, deliver value and capture value or through changing their value propositions (Bocken, 2013). Therefore for future sustainability, business model innovation plays a key role.

Schaltegger (2012) considers that innovations should start or change at the core of the business model to tackle challenges of a sustainable future rather than a supplement to prevent negative outcomes of business. The desire of business model innovations should be high and expanding societal and environmental benefits rather than focusing only on commercial gain. Business model innovations may not be economically feasible in the beginning but may become beneficial in the future due to regulatory or new changes. However, to implement innovative technology in sustainable development based on innovative business models requires the better understanding of customer needs and behavioral change (Baldassare et al. 2017). Ultimately the business model innovation is to create value for customers, companies and society, and also it is replacing old-fashioned models (Osterwalder and Pigneur, 2010).

3.1.2 Summary of business model elements for sustainable development

To identify key elements, a literature review has been conducted from different articles and some business models like Osterwalder business model Canvas are reviewed which focused on business models and sustainable development. The key elements from different articles are summarized in table 2.

Table 3.1 Business model parameters for sustainable development

AUTHOR (YEAR)	METHOD	FOCUS	BUSINESS MODEL ELEMENTS FOR SUSTAINABLE DEVELOPMENT
ABDELKAFI AND TAUSCHER (2016)	Qualitative Literature review	Investigates the inner logic of business model for sustainability by different perspectives and systems.	Value creation
BOCKEN ET AL. (2013)	Qualitative Literature review and case study approach	Investigates how business can create value by integrating sustainability	Value creation and business model innovation.
BOCKEN ET AL. (2014)	Qualitative Literature review	Investigates archetypes to deliver sustainability from literature and practice	Innovation, material productivity, energy efficiency, value proposition, stakeholders
GAUTHIER, C AND GILOMEN, B ET AL. (2016)	Qualitative Literature review	How Organizations transform and engage in sustainability	Value proposition, financial model, supply chain, customer interface.
LOORBACH AND WIJSMAN (2013)	Qualitative Literature review and case study approach	Applied transition management approach to business	Transition management and societal value
SCHALTEGGER ET AL. (2016)	Qualitative Literature review	How business model development by sustainable transformations can be used in mass markets.	Innovation, sustainability transformation.
STUBS AND COCKLIN (2008)	Quantitative Abductive combined with case study and grounded theory methods	Research on characteristics and components of sustainable business models	Collaborative partnerships, structural and cultural changes

In Osterwalder (2010) ontology, the business model is described in nine different blocks. This shows the logic of how a company intends to make money. It covers the four key main areas of business: customer interface (segments, relationships, and channels), product (value proposition), infrastructure management (activities, resources, and partners) and financial aspects (revenues and costs). The nine building blocks are presented in Table 3.

Table 3.2 Business model Canvas and blocks (Osterwalder, 2010).

Key Partners	Key Activities	Value Proposition	Customer Relationships	Customer Segments
	Key resources		Channels	
Cost Structure		Revenue Streams		

3.2 Sustainability and Sustainable Development

The sustainability topic is one of the most crucial topics for a company’s business success. It is a key driver for both risks and opportunities in the business. Not only strategic management, elements like sustainability can also influence the success of the business through the market or nonmarket processes (Schaltegger, 2011).

Sustainable development generally quoted as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland, 1987, p. 292). Thus, sustainability is defined as protecting the environment by using resources wisely not only in the place we live but also taking care of the future needs (Ballard, 2016). According to Parkin (2003) definitions of sustainability or information about sustainability does not provide any blueprint but helps to provide a framework that can be used for a project or any initiative that can contribute to sustainable development

In modern society, after observing different environmental problems sustainability measures seems to be the only solution for environment care. There is a need for application of sustainability measures in every sector such as construction, transportation, and agriculture. One of the major energy consumers is construction sector, therefore, it has an important role in contributing to sustainable development (Sev, 2009).

To achieve sustainable development for society and also for the construction sector, there is a need for intelligent decisions that includes observation with the broad knowledge of impacts created by the change. The concept of sustainable development reminds the humanity’s place on this planet. It gives the idea of the importance of humanity and sustainability (Sev, 2009).

The three important pillars of sustainability are social, economic and environment, these are significant in the construction of building because mostly 90 percent of time

people live in buildings (Trinius, 2007). The goals of sustainability can be achieved by implementing sustainability factors and key elements in business models. Mostly sustainable development is conceptualized in this way of having three dimensions: environmental, economic and social.

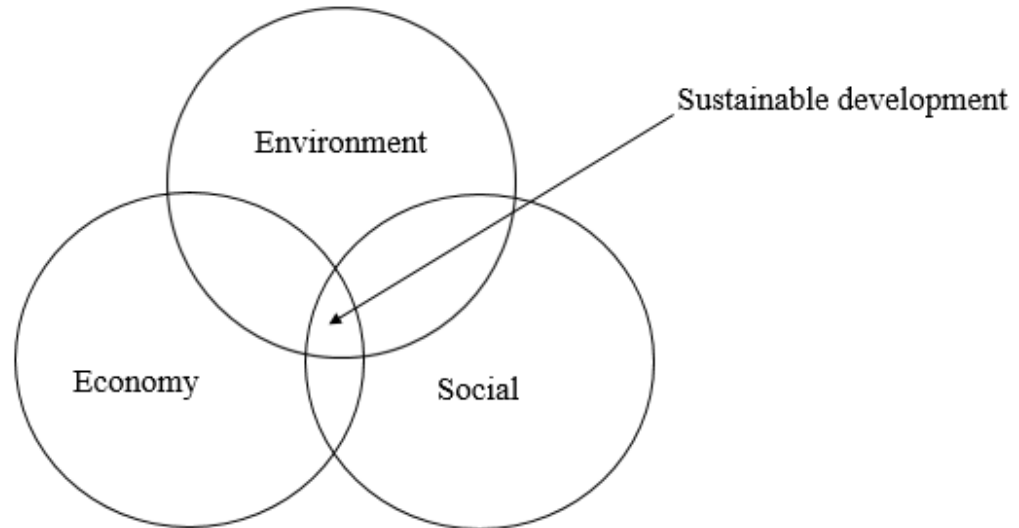


Figure 3.1 Sustainable development dimensions (Parkin, 2003).

The main point about sustainable developments growth is, the sustainability movement is already there but it will grow when the large number of people, companies, and organizations recognizes its value (Parkin, 2003). The ultimate objective of sustainability can be achieved by integrating natural, economic and social systems.

3.2.1 Sustainable Construction

The construction industry has a major role in sustainable development. It should balance human needs by taking care of resources in a sustainable manner because nearly 70 percent of a person's time is spent indoors in this modern society. Architecture and designs have the key role in making construction industry more sustainable. Architecture has an essential role because occupants health, safety, comfort, satisfaction, and productivity is important than any other thing. Many building designers are focusing on style and making than environmental care and human satisfaction, not only building sector whole built environment is in this way (Sev, 2009).

In recent years, sustainable construction has become an important factor for many private sectors and public decision makers, also there is widely growing support for sustainable urban development. In Europe, national and local planning strategies, the responsibility of promoting sustainable urban development by architects, builders, developers, and policymakers is increasing (Moore, 2008).

Kibert (2016, p. 10) defined sustainable construction as “creating and operating a healthy built environment based on resource efficiency and ecological design”. The central aspect of sustainable construction is however based on reducing natural resource consumption and impact on ecological systems. Kibert (2016) also mentioned seven principles of sustainable construction which benefit in the construction process and in the design phase: Reduce resource consumption (reduce), reuse resources (reuse), use recyclable resources (recycle), protect nature (nature), eliminate toxins (toxins), apply life-cycle costing (economics), focus on quality (quality).

3.2.2 Sustainable buildings

There are many definitions of sustainable buildings. For example, Kibert (2016, p. 11) defined sustainable buildings as “healthy facilities designed and built in a resource-efficient manner, using ecologically based principles”. Whereas Burnett et al. (2005) stated; a sustainable building delivers better efficiency in resource management and operational performance and reduce risks to human health and environment. It is also important to mention that sustainable buildings are interchangeable with terms green buildings, high-performance buildings, and energy efficient buildings. Most of the sustainable buildings definitions are related to environmental aspects.

It is considered that 21st-century cities must be greener and smarter, in respective of this promoting sustainable cities has become a major issue for many developing countries. The sustainability concept is a vast global issue consisting various interrelated studies of people, environment, and society (Ghaffarian Hoseini, 2013). Awareness of sustainable buildings is increasing day by day in the public. However, there are a lot of debates going on sustainable building regarding what it is and what it should cover. Actually, there is no proper or clear definition of the sustainable building which creates further challenges and many questions to implement or promote sustainable buildings (Ghaffarian Hoseini, 2013).

The sustainable building concept creates a necessary performance and functionality with low impact on the environment and also it increases improvements in social and economic aspects in local and global regions. The three main important requirements for sustainable buildings are the availability of sustainable technologies; the availability of methods and ability for sustainable design, procurement, management of buildings; and adoption of new sustainable building technologies, process and working models (Häkkinen, 2011).

The implementation of sustainable building involves many stakeholders, clients, and customers. Tenants also play a major role in this process the construction industry can only maintain sustainable standards (Darko and Chan, 2017). There is also necessary addressing the concept sustainable buildings from different perspectives and involvement of different sectors. Considering this, Häkkinen (2011) argued that the best way to increase the demand for sustainable buildings is to create awareness of sustainable building benefits for the customers and clients. Whereas a business model involving different key stakeholders and other important aspects such as innovation and awareness on benefits of sustainable building helps to reach the aim of sustainable buildings.

Mainly, by adopting sustainable building strategies both economic and environmental performances can be increased. To achieve this, integration of sustainable construction methods will be helpful. This can be implemented in different stages of the building for example, at the design stage, construction stage, and renovation and demolition phases. However, meaningful benefits can be obtained from sustainable buildings if the integration approach is planned and applied in the early stages of the project. Figure 3 presents the potential benefits of the sustainable building concept. These are outlined in three domains: environmental, economic and social benefits (Sayigh, 2013).

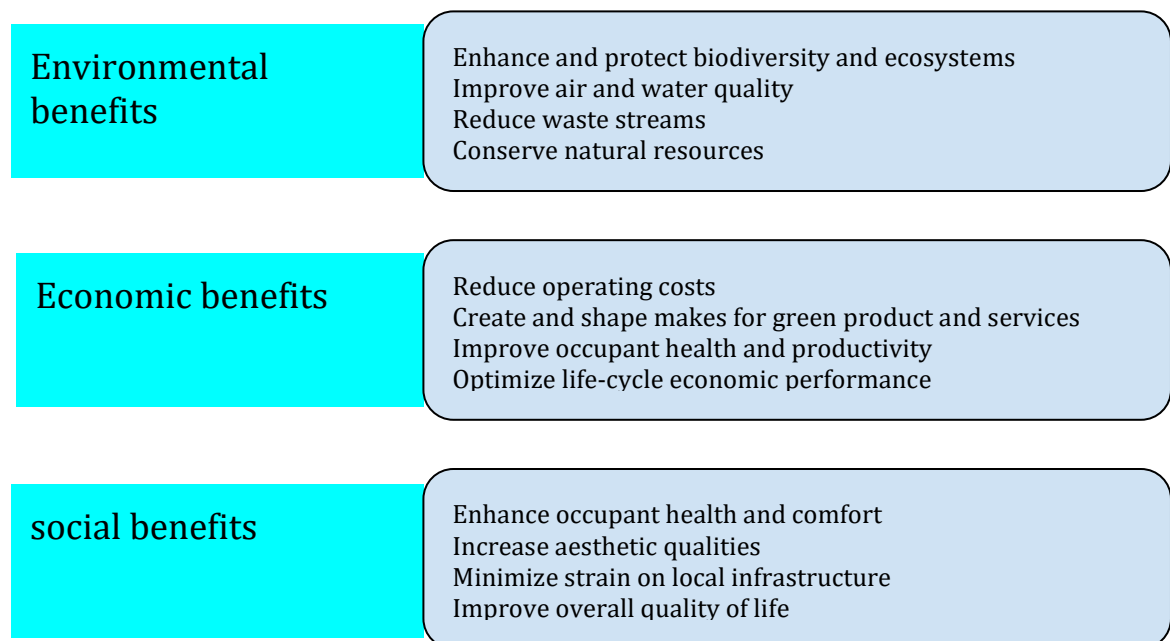


Figure 3.2 General benefits of sustainable buildings (Sayigh, 2013).

3.3 Business models for sustainable development

Businesses are always dealing with sustainability issues, but since 1970's social and environmental aspects became focused and influenced businesses on both individual firms and policies (Loorbach and Wijsman, 2013). Sustainability has become one of the prominent factors for successful business in long-term.

Business models with sustainability as main factor is discussed in different ways such as sustainable business models and Business models for sustainability (BMfS) (Abdelkafi and Tauscher, 2016). Companies integrate sustainability as a fundamental part of the company's value proposition and value creation logic. Thus, BMfS add value to the environment, society, and customers.

The key challenge is to design a business which is characterized by creating economic success through a positive environment or social activity (Schaltegger, 2012). Research has suggested various ways to understand, develop and analyze these business models for sustainability. Some approaches can be, how well-established firms can change completely their current business model towards a BMfS or how they can develop business cases for sustainability. Other approaches are a generation of complete new BMfS's or on the categorization of existing BMfS into different archetypes. These approaches are helpful to get insights about BMfS, but they do not conceptualize the relation between the company, its customers, and the environment. Particularly, it is not specified how value creation, natural environment, and profit generation can mutually complement and strengthen each other (Abdelkafi and Tauscher, 2016).

With the active involvement of responsible businesses, sustainable development can be achieved easily that is because the private sector plays a key role in creating sustainable, employment production, economic wealth, infrastructure based on sustainable development and innovation that can increase green growth and opportunities for all (Graves and Lingnau, 2016). However, Franca et al. (2017) consider that the ongoing degradation of ecological and social systems and work to turn this direction towards sustainable development, is changing the overall conditions of businesses in the present scenario.

A business case for sustainability is a sort of activity system which provides resources and manages activities in a value creation process by showing variance i.e. a business model for sustainability is a structural template that creates business logic for sustainability (Lüdeke-Freund, 2009).

The core of the sustainable business model is to create sustainable value proposition: mainly a value proposition that integrates multi-stakeholder process by considering customer needs, shareholders, investors, employees, the environment and society (Baldassare et al. 2017). However, Yang, M. et al. (2017) argued that there is a need of more comprehensive understanding of value processes and approaches to achieve sustainable business models. Creating sustainable value is a way for companies to promote their business, being innovative, and achieve competitive advantage. Considering today's competitive context, companies need to carefully deal with social and environmental dimensions in their business activities (Laszlo, 2008). Ultimately, a business model for sustainable development is focused on value propositions. Talonen and Hakkarainen (2014) argued that there is no sustainable business model in reality but a successive reasonable business model can be developed.

4 Results and Findings

This chapter focusses on case studies, the case studies are divided into two types' individual buildings and companies. Those are Little greenie project, The Bullitt center, Ramboll and White Arkitekter. These case studies are identified on the basis of best performance buildings and best companies that are responsible for sustainable buildings. The case studies are chosen according to key elements that are required for construction of sustainable buildings.

4.1 Case study - Companies

Two Scandinavian consultancy companies White Arkitekter and Ramboll have been used as case studies to identify key elements in business models.

4.1.1 Case study 1 - White Arkitekter

White Arkitekter is one of the leading architecture firms in Scandinavian countries. It was founded 1951 in Gothenburg, Sweden. Their leading position in environmental design, sustainable master planning, and healthcare projects has brought together attention from around the world. Key elements identified with relation to a business model perspective according to White Arkitekter (2017) are:

- Their aim is to create environments which improve quality of life and wellbeing of people and fight climate change through their valuable projects.
- White introduced a sustainability architecture model that is established on the basis of global challenges, commitment to the global compact, expectations of our clients and society, national and local derivatives and targets. The sustainability architecture model includes 7 primary aspects and contains subcategories. They are climate adaption, ecosystems & water, energy & climate, long-term economy, equity & participation, health & wellbeing and materials & hazardous substances & waste.
- Sustainability is an integral part of the white projects. They created a management system which ensures sustainability goals are implemented from beginning to completion. This involves backgrounds from different pieces of knowledge who have experience in environmental management and analysis and a wide knowledge in low energy solutions.
- Innovation is one of the core practice and culture of the company. They also have invested heavily in research and development. Their research advancement leads towards new digital technology providing opportunities for new architecture, through new designs. The most effective processes are achieved through BIM.
- In their view, smarter buildings can be created by using new technologies. By self-driving techniques, the pressure on future cities can be reduced. Digital

design methods are the new tools to support sustainable, optimized design and also to lift the construction and architecture to the next level.

- The key elements in White Arkitekter business model are shared responsibility, collaboration, and research. White has three important policies: employee policy, quality policy and sustainability policy (White Arkitekter, 2017).

Key lessons learned:

- White Arkitekter avoids the projects if it does not meet the sustainable standards.
- Sustainability is a driver for creativity and good architecture. Additionally, White follows a holistic approach and a long-term perspective.

4.1.2 Case study 2 - Ramboll

Ramboll is a dominant company in design, research, consulting and engineering. It is founded by Ramboll group in Copenhagen, Denmark in 1945. Nearly 13000 employees are working in this company as management consultants, designers, and engineers. Ramboll is leading in different markets such as buildings, urban design, transport, water & energy, environment & health, oil & gas and management consulting. Key elements identified with relation to a business model perspective according to Ramboll-environ (2017) are:

- The company's mission is to create sustainable societies where people and nature are given highest importance and its vision is to deliver integrated and sustainable solutions. Their further ambition is to make firm as a leading sustainable society consultant by developing the strong platform for sustainable growth.
- The company earned reputation by science-first consulting which is they focused more on innovation, scientific and technical excellence. Due to strong science and technology advancements, even their clients face challenges because of complexity. They face this kind of challenges by addressing and adding new services that contribute scientific advancements and also by expanding geographically.
- They gain huge respect and loyalty from private and public clients from around the world because of clear insight, integrity and strong focus on client service.
- They help clients in understanding global market trends and local changes, so they can respond on business, regulatory and legal issues and also develop sustainable strategies to overcome these challenges. Not only business-related issues they also gain sufficient knowledge in global environmental issues such as implications of health, urbanization, climate change and resource scarcity (Ramboll-environ, 2017).

Key lessons learned:

- Ramboll believes in high ethical standards, employee satisfaction and responsibility towards client and society.
- In 2016 Ramboll delivered strong performance due to committed employees and productive collaboration with clients and partners

- “Cities can improve their urban thermal environment if they change their architectural and engineering structures and layouts”, (Survey conclusion, US national library of medicine).
- To create a more sustainable urban design, the understanding urban microclimate is necessary which includes pollutant level, wind distribution and thermal characteristics in all stages. This process is done by four different assessment tools - air ventilation assessment, daylight analysis, heat gain analysis and glare analysis.
- To make more cities livable, involving different kinds of knowledge, skills and insights are important.

4.2 Case study - Individual buildings

Individual buildings are selected to identify the key elements they used in the buildings. These buildings don't have any separate business models, so these buildings are used as support to identify the elements in the case studies.

4.2.1 Case study 3 - Little Greenie

Little greenie building is located in Golden Bay in New Zealand, it is rated as highest energy efficient home in New Zealand. It is established as one of the healthier, sustainable and energy efficient building. Key elements identified with relation to a business model perspective according to Goldenbayhideaway (2017) are:

- Little greenie building was constructed with world's best practices based on five guiding principles - Energy efficiency, low maintenance/longevity, the simplicity of construction, value for money, craftsmanship.
- Little greenie project is designed based on passive solar and low energy design methods. The building has excellent water and energy efficient systems, it has good ventilation and well designed to balance humidity performance and its main feature is to minimize maintenance costs.
- The house has been designed with innovative techniques to reduce the maintenance costs in the future.
- This house considered from a whole house perspective, the systems and elements used to build this house helped to provide the high-performance environment and also yield on the return of investments. The analysis of this building provides a clear view of benefits. However, the most important concept that shouldn't be forgotten is this type of buildings provides a significant level of comfort which cannot be measured by prices and economic models.
- The energy use results of the building are outstanding. The energy cost savings are nearly \$670 per annum. This represents the pure benefits of the house. However, the house provides significant level of comfort which cannot be compared with economic models.
- In addition to this, there are additional benefits such as environmental benefits from reducing usage of paints and also psychological benefits (Goldenbayhideaway, 2017).

Key lessons learned:

- Comfort and design are the highest preference in the project.
- Additional benefits from this project are, using high-level craftsmanship for extensive designs and, special care for colors and traditional look for basic appearance.

4.2.2 Case study 4 - The Bullitt center – High-performance building

The Bullitt center is maintained and owned by the Bullitt Foundation. The project site was at Madison Street in the 15th avenue. It is surrounded by a mixture of different restaurants, shops, private and public schools and parks. Its mission is to protect the natural environment by supporting human activities and promoting sustainable communities in the Pacific Northwest. Key elements identified with relation to a business model perspective according to DEI Creative in Seattle (2017) are:

- The building has overtaken expectations in the first year of operation for thermal comfort, daylighting and also energy use. During the first year of operation, the building was warm, cool and comfortable in the summer and draft-free in the winter, and also attractive daylight around the year. Tenants expressed a high level of satisfaction for the quality and comfort of the indoor environment.
- The central vision for this building is energy efficiency and renewable energy
- The Bullitt center is designed and built for a long-term perspective. The building will operate mainly on available site resources and also will pay for the energy efficient materials and by reducing carbon footprint in construction.
- The building is designed in a way that it restores the natural hydrology of the site and return nutrients to the land. It also provides a healthy environment to the people who come here to work and do activities. In this, the building also provides ecosystem services.
- The steps followed by Bullitt design team are: Setting aggressive goals, Analyzing the site and climate, designing for low energy demand, using efficient equipment, using renewable energy, verifying performance (DEI Creative in Seattle, 2017).

Key lessons learned:

- A visionary team (building owner, an integrated design and construction team, progressive financial partners and supportive regulatory agents) came together with a common purpose to construct this building. This indicates a support and common goal of different people helps to achieve sustainability visions.
- Integrated design is the main feature of this building.

5 Analysis

In this chapter, case studies and suggested business model are analyzed. Suggested business model is designed from the analysis of both theoretical framework and case studies. This will be major for the thesis and to discussion.

5.1 Case study analysis

Table 5.1 Summary of Case study elements.

Case study	Elements covered
A. Private companies	
1. Ramboll	Sustainability, customer satisfaction, innovation, Knowledge oriented.
2. White Arkitekter	Sustainability, collaboration, research and shared Responsibility, innovation and new technologies.
B. Individual buildings	
3. Little greenie	Design, sustainability, comfort, and appearance.
4. The Bullitt Center	Integrated design(technology), customer satisfaction, sustainability(energy efficiency and Renewable energy).

The both private companies Ramboll and White Arkitekter followed and focused similar elements like sustainability, innovation and customer satisfaction. White Arkitekter and Ramboll are very strong companies in applying sustainability. These companies focused mainly on sustainable projects which brought them name and money. Both companies' business models focused on knowledge oriented systems and learning process, so the business model elements are always new and depends upon the project. On the whole, the both companies main focus is on sustainability.

The individual buildings differ companies, since these buildings in themselves do not have business models. Therefore the elements from these cases constructed based on sustainability as the main factor. Both buildings focused on design, because it is the major factor to reduce costs and for comfort and appearance. Energy efficiency and renewable energy were the important elements in both of these buildings

The analysis has done to identify the key elements for business model for sustainable buildings. From the literature review and case studies, important elements are taken and framed into a business model. This business model can be a suggestion for practioners and researchers. The suggested business model also helps to work further on research and business.

5.2 Suggested Business model

The suggested business model framework is the analysis of the whole thesis process. In this thesis process, understanding of business models and sustainability concepts as well as identifying the important key elements stands as a bridge for developing the business model framework. The suggested business model elements are the output of the literature, case studies and the critical analysis. The additional elements are categorized into subtopics under the main elements. The suggested business model elements are presented in the Table 5 and their subtopics are presented in the figure 4.

Table 5.2 Suggested key business model elements for sustainable buildings

Sustainability	Value proposition
Networking	Innovation

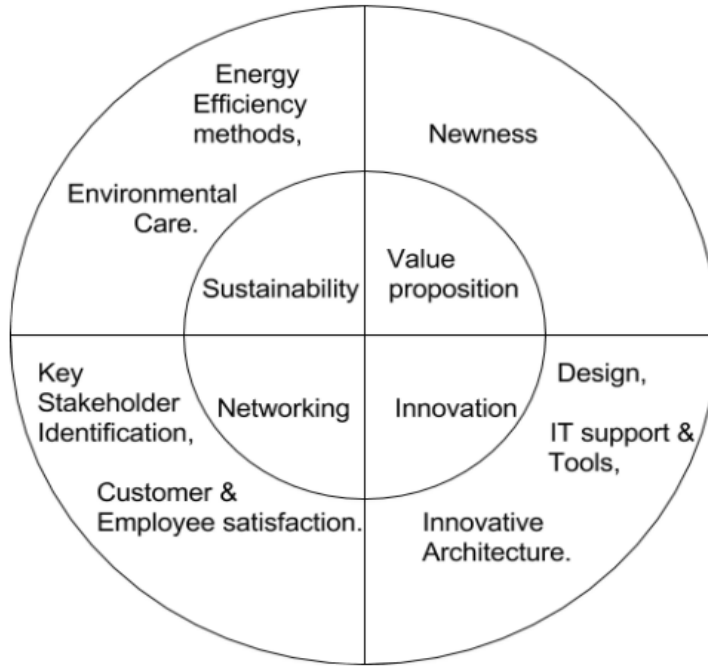


Figure 5.1 Business model with subtopics

The elements and sub-elements of the proposed business model presented in figure 4 are described below:

- 1) **Sustainability** - A business model with sustainability as a main factor is to promote environment based business and provide healthy facilities in a resource efficient manner. Sustainability can be a successful business factor in long-term. Sustainability is the main concept in the thesis and it is also the most important and reviewed concept in both theoretical framework and case studies. The sub-elements in sustainability are:
 - a) **Energy efficient methods** - Energy efficiency is about control on equipment and right sized efficient systems to minimize energy demands and deliver optimum usage. According to Sayigh (2013) energy efficiency is the best way to reduce demand on energy and also to reduce GHG emissions (greenhouse gases). To maintain sustainability in buildings, energy efficient methods are necessary, to reduce electricity and also for economic benefits.
 - b) **Environmental care** – Environmental care is considering and giving highest importance to environment in the construction and maintenance processes. To be sustainable environmentally, conscious care of using materials is important. The important element in sustainability is environmental care. To conserve natural resources in building processes and to maintain sustainability environment protection should be given highest importance.

- 2) **Innovation** – To tackle challenges of a sustainable future, innovations should start or change at the core of the business model. Innovations help companies to replace old-fashioned models, thus it helps to create value for customers, companies and society. Being sustainable in the present world is expensive and also difficult to adopt sustainability measures, to sort out the difficulties and to improve sustainable measures in the company, innovation plays a major role.

Innovation is selected as one of the main element in the business model, in both literature and case studies innovation is identified as one of the key topic and major in business models. Because every company tries to change or create business models to run the company. Innovation for sustainable buildings can be seen in different types like focusing on design and IT support & tools. The sub-elements in innovation are:

- a) **Design** – Good design has the capability of integrating different systems like functionality, adaptability and maintenance etc. Good design also allows easy and efficient construction, commissioning and handover. Moreover, knowledge of end users also impacts on the management, operation, and maintenance of indoor environments, water, waste and energy. However much of the intention is in design, due to bad construction quality and lack of commissioning it might affect good design (Burnett, 2007). For sustainable buildings design plays a key role either for architecture or managing the building system.
- b) **IT support and tools** – The IT support and tools are used for managing intelligent building systems and data processing for environment rating tools. These IT tools can also be used for managing data in related to risk and life cycle assessment.
- c) **Innovative architecture** – Innovation plays a fundamental role in development of sustainable architecture. Whereas, innovative architecture has the strength in applying proper designs, for comfort, space and new look for the building. This ultimately raise the advantage of the building and also become the major factor for the business to grow.
- 3) **Value proposition** – According to Osterwalder (2010) a company's value proposition is what it differs from its opponents. It describes the advantages that customers can expect from the products and services. The value proposition includes value through different elements, such potential value has the capability to offer greener, sustainable and environmental friendly services. The sub-elements in value proposition are:

- a) **Newness** – New value proposition is something that which is totally different from the opponents which can help businesses succeed where customers perceive the new type of service.
- 4) **Networking** – Networking is a process of identifying and meeting different stakeholders for business activities. It is necessary to meet different stakeholders for resources and activities and to access customers. Networking with different stakeholders became common in the present modern world. The sub-elements in networking are:
- a) **Key stakeholder identification** – This business model consists a different variety of elements. In order to reach targets, specific group of stakeholders are necessary. This makes company with strong networks and helps to become a knowledge oriented system. Identifying key stakeholders helps to achieve goals.
- b) **Customer and employee satisfaction** – Customers and employees play a key role in delivering company's goal to society. Customer satisfaction and employee satisfaction can be a major element in business model to achieve goals, and also customer and employee satisfaction plays a major role in networks with other customers and stakeholders.

6 Discussion

This chapter contains about general discussion and reflections. The implications of business models and sustainable buildings is also discussed according to the research question.

Business models is a topic that is used in different ways and there is no proper blue print for the application of business models. However, there are few authors who mentioned and shown importance about business and its concepts (Fielt, 2013). In this thesis the main concept is about investigating important elements required to build sustainable buildings. In this process different concepts and case studies are reviewed and a new business model is designed including key elements for sustainable buildings.

Different authors has mentioned business models in different ways. For example, Osterwalder (2005) described business model as a concept to express the business philosophy of an organization. Moreover, business models are also described in the form of elements. So the important challenge in the thesis is to find out those key elements required for sustainable buildings from business model perspective. From the literature and case studies it is clear that value proposition, innovation, networks and sustainability are key elements in business models for sustainable buildings. But the main point is application of changes into construction industry.

These indicators or elements for sustainable buildings are challenging to achieve. There is no perfect business model or proper dimensions to achieve 100% sustainability from buildings and gain money out of it. It is good to have some basic dimensions or elements to consider and start with them. The whole story of this thesis revolves around the use and importance of elements.

However from the literature it is identified that innovation plays a key role in business models to be profitable and successful. Whereas, Boons (2013b) review shows that innovation is an important topic in the literature on business models as a main aspect for competitive advantage and renewing companies.

The literature on sustainable development gives a clear idea that there is lot of interest from different companies and governments to promote sustainable development and implement sustainable measures. But the process looks slow due to lack of integration between different sectors and less attention from common people.

Sustainable building is a topic where much research is needed. In this thesis, the research has focused on sustainable buildings, business models and sub-topics. In brief, sustainable building can be defined as “building with a minimum environmental impact” (Priemus, 2005, p. 6). To implement different technologies, concepts and innovative ideas to build sustainable buildings, it is necessary to focus on business models and its elements. This thesis contributed and identified key elements and provided a basic research on business models and sustainable buildings. Overall, to be profitable from sustainable construction, companies or firms may need to change their business models, activities, revenue models and networks.

A holistic approach is necessary to apply the concept of sustainability to sustainable buildings or in construction works and also bringing together the goals of sustainable development, and requirements and necessities in terms of functionality, economy and efficiency. It is also necessary to understand the users and involve them in design phase because they may have a different perspective on the challenges and solutions.

In my opinion, there is enough research done on sustainable buildings that can be applied in constructing sustainable buildings. But, the research looks like it covered overall points from an international standard rather than considering individual country requirements. Mostly, the construction sector is depended on local knowledge and differ in circumstances and content, it also varies from one place to another place. The reason for this is the public and private sectors interest on sustainable buildings is different in different places. As stated in the introduction, the aim of this thesis is to bridge the gap between business and sustainable buildings through analysis of important key elements.

From the results it seems as that there is a gap between theoretical research and practical data. The key findings from the case studies are important elements used for construction of buildings and elements used in the business model of the companies. Sustainability is the main factor in all the case studies. But the major part to discuss is in what way sustainable measures are applied. For example, the Bullitt center's main focus is on integrated design by using technology and energy efficient methods. The Little Greenie building mainly focused on design and comfort through that they want to provide sustainable and a healthy living. Whereas, the both private companies main focus is on collaboration, innovation and knowledge oriented. The case studies helped to provide practical information and data, so that important elements and practical approach are learned. These elements are combined with theory and a new business model was designed.

It is also important that practical things should be combined with theory for efficient delivery of sustainable buildings. There is necessary to combine business and sustainability concepts in all sections (Individual buildings and companies) to be profitable and to sustain in the long run. This is of less importance within the theory and also in practical applications. Business models with necessary elements has the capability to address the issues related to non-sustainability. Most of the companies in the construction industry are based on technical and work efficiency rather than importance of sustainability. The elements of innovation and new value proposition (newness) helps companies and people to see the new changes in the construction industry and also it will be a learning process for both companies and society.

6.1 Implications of Sustainable business models and Sustainable Buildings

In my view, there is a communication a gap between academic knowledge and the practices at the local construction sector. This can be one of the reason for the lack of growth of sustainable buildings. Even in many developing countries like India, this gap can be seen clearly. For example construction in India is mostly depended on local contractors and builders. The local developers are not involved in research and development in any way. The governments are also responsible for this kind of situation. Above all, there is need of government responsibility to raise awareness and importance of sustainability and sustainable buildings. The other major barriers are affordability, lack of client demand and lack of client awareness. Affordability is a major barrier for sustainable construction which might indicates that sustainable building will be expensive compared to regular practices. Moreover, the theoretical knowledge on sustainable buildings can be seen in research and development and higher education but not in different levels of education.

Ultimately sustainable buildings consume less energy, materials and provide healthy environments and better living conditions. Sustainable buildings or sustainable businesses make profits from a long-term view without causing environmental damages.

New business models for sustainable buildings helps to promote sustainability and also it opens doors for employment, technology, innovation and new systems. Because to construct sustainable buildings it is necessary to consider certain things like tools, research and involvement of different stakeholders.

Business models with proper experimentation and leadership in sustainability leads to achieve goals. It is true that most of new business are failure, a wide research is necessary to be successful in business. Innovation has the capability to change the business models and sustainable buildings.

Sustainable business models has greater chance in today's business and competitive environment. Because most of the companies are not much focused on sustainability and its measures. Currently, people are realizing the importance of sustainability so it is necessary for new companies or existing companies to focus on key elements that are required for business models.

7 Conclusion

The aim of the thesis is to understand and contribute to the construction of sustainable buildings from a company (owner or start-up) perspective. So this research has lead towards enquiry of business models and sustainability and other important aspects (Innovation, value creation, etc.). As a result, important information has been acquired and learned. Consequently, a new business model has been designed from the knowledge acquired.

Sustainable buildings is one of the solution for the present day environmental and resource crisis in construction industry. Sustainable buildings enhance the living environment for the occupants, while maintaining sustainability and being eco-friendly. It is not only a cost effective option but also an option for national and global economy. Business models for sustainable buildings can raise awareness of sustainability and sustainability buildings from a company perspective.

From the thesis important elements are identified with a new business model framework which helps to give the basic idea on business model elements for sustainable buildings and a new kind of approach to address the non-sustainability issues in building sector. Through this business model and important elements there can be a solution for the growth of sustainability and to implement different concepts and ideas to buildings or construction sector.

The results showed that the business model elements has the capability to implement the sustainability measures. The concepts innovation and value proposition are the most reviewed in literature. In the thesis, a new framework is designed from the combination of both literature and case studies.

The conclusion is, by adopting and creating new business models leads to overcome non sustainability issues.

This thesis is intended to pursue basic knowledge on business models and sustainable buildings for my own interests. The result can be used as a guideline for practitioners and researchers. This gave me lot of interest and confidence to work more on business and sustainable buildings. Hopefully this work can contribute a little to the research in the field of business models and sustainable buildings and provide a basic literature and business model framework for future research.

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