Master's thesis

NTNU
Norwegian University of Science and Technology
Faculty of Economics and Management
Dept. of Industrial Economics and Technology Management

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Software Business Models: Adaptation to External Factors

Master's thesis in Industrial Economics and Technology Management
Supervisor: Øyvind Bjørgum
June 2020

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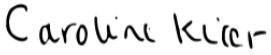
Preface and Acknowledgements

This master's thesis is written as part of a Master of Science in Industrial Economics and Technology Management at the Norwegian University of Science and Technology (NTNU). The study contributes to fulfilling the requirements for a specialization in Strategy and International Business Development, and was carried out during the spring of 2020.

The author would like to thank the academic supervisor, Øyvind Bjørgum, at the Faculty of Economics and Management at NTNU. During the study, Øyvind has been an important discussion partner, contributing with insight and feedback. The author appreciates his continuous availability and guidance, combined with freedom in forming the thesis.

Also, the author thanks the management representatives from the eight case companies 24onoff, Catenda, Checkd, Dimension10, Disruptive Technologies, Parallelo, Varig, and one company that chose to be anonymous, for their participation and contribution in this study. Their interview answers form the basis for the empirical analysis.

Finally, the author would like to thank Elin Young and Daniel Kinn from the Deals Real Estate Department in PwC, for sharing their knowledge on technology development in the real estate industry, as well as for their encouragement througout the work.



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Abstract

Today's rapid technology development gives software companies numerous opportunities. Several researchers emphasize the importance of exploiting these through adaptation of the companies' business models. In spite of this, there is limited theory on the field. The combination of rapid software industry growth, with continuous new technological developments, makes it challenging for software companies to maintain a good business model over time.

This master's thesis aims to increase knowledge on how software companies adapt their business models to a constant change in external factors. With this knowledge, it is believed that software companies can improve their value proposition to their customers. Also, they may capture greater value through increased profits, which facilitates growth.

Through interviews with managers in eight small software companies, this thesis contributes with qualitative empirical data on adaptation of software companies' business models to external factors. All eight companies in the study develops software solutions for the real estate industry. The wave of digitization has caused major changes in this industry in recent years. From primarily developing *Building Information Models*(BIM) to the real estate industry, a wide range of software solutions are now offered for both construction and operation of buildings. These include *Virtual Reality*(VR) and 'digital twins', as well as 'smart building' solutions with built-in *Internet of Things*(IoT) technology.

Software companies' opportunities in new technology development are influenced by external factors. This study focuses on the impact of four external factors that affect the case companies to a large extent. These are *technological development*, *societal trends*, *environmental focus* and the *corona situation*.

The thesis finds that software companies' business models can be broken down into six components: *activities*, *resources*, *value proposition*, *partners*, *customers* and *revenue streams*. Through a comprehensive theoretical and empirical analysis of these six components, it appears that the last four are most prone to adaptation to external factors. This is due to 1) that they have a high degree of internal variation, which allows for many different 'component designs', 2) that they all involve a high degree of customer interaction and 3) that they are prone to small adaptations.

New technology is found as the external factor impacting the business models of software companies the most, because it enables new opportunities in software companies' value propositions and revenue models. Also, new

technology ensures a supporting technological infrastructure. The study finds that customer preferences shape how external factors affect software companies' business models. For example, even with available technology, it is not favorable to offer solutions based on *Artificial Intelligence*(AI) for predictive maintenance if this is not desired by the customer, or it is not offered at a price customers are willing to pay. Under major changes in external factors, such as experienced during the corona situation, the study shows that software companies are particularly prone to adaptation compared to companies in traditional industries.

For software company executives to be able to apply the findings of this study in practice, the 'Adaptation Model' is developed. This model is based on the four components most prone to adaptation: value proposition, partners, customers and revenue streams. The model shows which adaptations the case companies make when impacted by external factors. When placed in the context of external factors, the model shows that adaptation of business model components are also influenced by the software companies' focus on opportunities, foresight and inspiration.

Sammendrag

Dagens raske teknologiutvikling gir programvareselskaper enorme muligheter. Flere forskere hevder at disse mulighetene kan utnyttes gjennom tilpasning ('adaptation') av selskapenes forretningsmodeller. På tross av dette er eksisterende teori på området svært begrenset. Kombinasjonen av rask vekst i programvareindustrien med kontinuerlig teknologisk utvikling gjør det utfordrende for programvareselskaper å opprettholde en god forretningsmodell til enhver tid.

Målet med denne masteroppgaven er å øke kunnskapen om tilpasning av programvareselskapers forretningsmodeller til en konstant endring i eksterne faktorer. Med denne kunnskapen er det antatt at programvareselskaper kan forbedre sitt verdiforslag til kunde. I tillegg kan programvareselskaper fange større verdi selv i form av profitt, hvilket tilrettelegger for vekst.

Gjennom intervjuer med ledere i åtte unge programvareselskaper, bidrar denne oppgaven med kvalitativ empirisk data om tilpasning av programvareselskapers forretningsmodeller til eksterne faktorer. Alle de åtte selskapene i studiet utvikler programvareløsninger for eiendomsbransjen. Digitaliseringsbølgen har de siste årene forårsaket store endringer i denne industrien. Fra å primært levere *Bygnings Informasjons-Modeller*(BIM) til eiendomsbransjen, tilbys nå et vidt spekter av programvareløsninger både til konstruksjon og drift av bygg. Disse inkluderer *Virtual Reality*(VR), 'digitale tvillinger' og 'smarte' bygningsløsninger basert på innebygget *Internet of Things*(IoT)-teknologi.

Programvareselskapers muligheter for ny teknologiutvikling påvirkes av eksterne faktorer. Dette studiet fokuserer på fire eksterne faktorer som alle påvirker case-selskapene i stor grad. Disse er *teknologiutvikling*, *samfunnsmessige trender*, *miljøfokus* og *coronasituasjonen*.

Oppgaven finner at forretningsmodellene til programvareselskaper kan brytes ned i seks komponenter: *aktiviteter*, *ressurser*, *verdiforslag*, *partnere*, *kunder* og *inntektsstrømmer*. Gjennom en omfattende teoretisk og empirisk analyse av disse seks komponentene, fremkommer det at de fire siste er mest eksponert for tilpasning til eksterne faktorer. Dette skyldes 1) at de har en høy grad av intern variasjon, hvilket gir rom for mange ulike 'komponentdesign', 2) at alle innebærer en høy grad av kundeinteraksjon og 3) at de er tilbøyelige for mindre tilpasninger.

Ny teknologi er den eksterne faktoren som påvirker forretningsmodellene til programvaresselskaper mest, fordi det gir nye muligheter i selskapenes verdiforslag og inntektsmodeller. I tillegg bidrar ny teknologi til å opprettholde en støttende teknologisk infrastruktur. Studiet finner at kundenes

preferanser former hvordan eksterne faktorer generelt påvirker programvareselskapers forretningsmodeller. Selv om teknologien er tilgjengelig, er det for eksempel lite gunstig å tilby kunder løsninger basert på kunstig intelligens for prediktivt vedlikehold dersom dette ikke er ønskelig fra kundens side, eller det ikke tilbys til den prisen kundene er villige til å betale. Under spesielt store endringer i eksterne faktorer, slik som selskapene har opplevd under coronasituasjonen, viser studiet at programvareselskaper er spesielt tilpasningsdyktige sammenlignet med selskaper i mer tradisjonelle industrier.

For at ledere av programvareselskaper skal kunne ta i bruk funnene fra denne oppgaven i praksis, er 'Tilpasningsmodellen' utviklet. Denne modellen er basert på de fire komponentene som er mest eksponert for tilpasning: verdiforslag, partnere, kunder og inntektsstrømmer. Modellen viser hvilke tilpasninger case-selskapene gjør som følge av påvirkning fra eksterne faktorer. Satt inn i konteksten av eksterne faktorer, viser modellen at tilpasninger av forretningsmodell-komponenter også påvirkes av programvareselskapenes fokus på muligheter, framsyn og evne til å tilegne seg inspirasjon.

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Abbreviations

Table 1: Abbreviations

Abbreviation	Description
AEC	Architectural/ Engineering/ Construction
AI	Artificial Intelligence
API	Application Programming Interface
B2B	Business to Business
B2C	Business to Customer
BIM	Building Information Modelling
BM	Business Model
BNL	Byggenæringens Landsforening
B of D	Board of Directors
ERP Systems	Enterprise Resource Planning Systems
HR	Human Resources
HSE	Health, Safety and Environment
HW	Hardware
IoT	Internet of Things
IP	Intellectual Property
ISS	Inner Source Software
ML	Machine Learning
OSS	Open Source Software
SaaP	Software as a Product
SaaS	Software as a Service
RE	Real Estate
R&D	Research & Development
SBM	Software Business Model
SME	Small and Medium-Sized Enterprise
SW	Software
SWAT	Strengths Weaknesses Opportunities Threats
VC	Venture Capital
VP	Value Proposition
VR	Virtual Reality

Interpretations of Terms

Table 2: Interpretations of terms

Term	Interpretation
Business Model	A description of how an organization creates, delivers and captures value
Intellectual Property	Intangible assets a software company has created as a result of combined knowledge and creativity
Proptech	A concept that encompasses information and platform technology in the real estate sector
Real Estate	Property including land, the buildings on it, and resources above and below ground
Resources (in a software company)	A software company's assets, capabilities, organizational processes, knowledge, information and attributes
SaaP	A copy of the software is downloaded by the customer, and runs on the customers' servers as long as the customer wishes. The customer carries the cost for the usage rights, support, maintenance and operations.
SaaS	The software is hosted online, and does not require any customer installation of software. The software vendor does not give away the software, only access and usage rights for a defined period of time. The software vendor carries the cost of software support, maintenance and operation.
Software Business Model	A description of how a software company creates, delivers and captures value
Software Company	A company offering software solutions
Software Solutions	Software based products and services, either used as they are when delivered or implemented in larger software solutions.

1. Introduction

In 2020, 44% of the businesses in Europe and North America plan to increase their tech spend (Spiceworks, 2020). Business companies' exploitation of *Artificial Intelligence* (AI)-powered technologies is expected to triple by 2021, use of edge computing is expected to double, and two thirds of large enterprises plan to deploy 5G technology by 2021. These trends indicate great opportunities for software companies all over the world.

Several renowned scholars argue that to succeed, companies need to continuously exploit changes and opportunities in the external environment, and adapt their *Business Models* (BMs) accordingly (Magretta, 2002; Teece, 2010; McGrath, 2010; Saebi et al., 2017). For software companies, this is particularly important due to rapid technology development.

Despite the fact that the term 'business model' is commonly used among practitioners in software companies today, there is no theoretical agreed definition of the concept. Several researchers stresses the need to find a generic definition and language of business models particularly for software companies (Rajala et al., 2003; Sainio & Marjakoski, 2009; Lindgren & Rasmussen, 2013), referred to as *Software Business Models* (SBMs) in this thesis. When it comes to *adaptation* of these SBMs, existing theory is severely limited and case-specific (Willemstein et al., 2007; Saebi et al., 2017). This gives few findings applicable for software companies in general, which raises the question if business model adaptation is performed in the most beneficial way by software companies today.

To contribute to this research gap, and lay a foundation for future adaptation of SBMs, this thesis combines existing business model theory with empirical findings from interviews with eight case companies. The thesis seeks to increase the understanding of how software companies adapt their business models to external factors.

All the eight case companies are small software companies targeting the *Real Estate* (RE) industry, directly or indirectly. The reason for choosing this empirical context is the large potential for software solutions in this industry (PwC & the Urban Land Institute, 2019). Also, the former conservative industry now shows more openness to adopt technological solutions (Bygballe et al.). This is evident from the increased number of new software companies targeting this sector, as well as increased willingness to invest in software companies targeting the RE industry. According to leaders of several global *Venture Capita*l (VC) funds interviewed by Forbes, increased amount of capital will be pouring into the *property technology* (proptech) industry, both as a consequence of technology buyers and investors (Donati, 2020).

The three external factors *technological development*, *societal trends* and *environmental focus*, currently impact the real estate industry significantly (Skanska, 2019; PwC & the Urban Land Institute, 2019). Therefore, they are chosen as the primary external factors to be investigated in this thesis. Through exploitation of technological developments such as *Virtual Reality*(VR), 'digital twins' and *Internet of Things*(IoT) technology, software companies may offer solutions that visualizes properties in 4D and enables 'smart' buildings. Societal trends include urbanization, which increases the need for improved efficiency in the construction industry. Environmental focus boost customer demand for environmental friendly software solutions, such as monitoring and control of CO2 emissions.

In addition to these external factors, the *corona situation* has impacted the global society and economy drastically during the spring of 2020 (Cantore et al., 2020). The corona situation is therefore also chosen to be investigated as an external factor impacting the case companies.

As adaptation of software companies' business models is essential for the companies' value creation and growth (Wittkop et al., 2018), this thesis seeks to increase knowledge related to how these models are adapted to external factors. Increased theoretical insight on this area enables software companies to maintain a good business model exploit opportunities through business model adaptation in practice. Therefore, this thesis aims to answer the following problem statement:

How do software companies adapt their business models to external factors?

2. Research Questions and Structure

2.1. Research Questions

To answer the problem statement, it is important to understand what the term *'business model'* encompasses, as well as characteristics of how these models are adapted in software companies. Various perceptions of the term are applied both in theory and practice. Therefore, a breakdown into business model components will be made to provide an overview of the complex concept.

It is assumed that some components are more prone to adaptation other components. Therefore, they are also adapted more often. To increase insight in SBM adaptation, it is important to understand *why* these components are most prone to adaptation. Therefore, the first research question is as follows:

1) Why are certain business model components more prone to adaptation to external factors than others?

Having understood the above, the next step is to understand how external factors impact these components. With this knowledge, managers of software companies gain increased insight in how their companies respond to different external factors on a detailed level. Therefore, the second research question is as follows:

2) How do external factors impact the components that are most prone to adaptation in software business models?

The knowledge on software business model components and impact of external factors, can further be combined to provide a solid foundation to answer the overall problem statement.

2.2. Structure

This thesis is structured as follows. In Section 3, *Theoretical Background*, relevant theory on business models in general, as well as business models of software companies in particular, is presented. Next, in Section 4, *Methodology*, the method used to gather and analyze information is explained. In Section 5, *Case Context and Companies*, the eight software companies used to gather empirical information for this thesis, will be presented. Also, the real estate industry, which all these companies target directly or indirectly, will be described. Thereby, in Section 6, *Analysis*, an

analysis of the findings from interviews with these case companies will be carried out. In Section 7, *Discussion*, the results of the analysis are combined with theory in a discussion of adaptation of software business models to external factors. Finally, in Section 8, *Concluding Remarks*, the findings of the thesis will be presented, and implications for managers and future research will be addressed.

3. Theoretical Background

In this section, existing theory on business models will be presented and explained. In the first part, emphasis is put on theory on BMs in general. The second part will focus on theory on business models of software companies in particular, referred to as *'software business models'*.

3.1. Business Model Theory

3.1.1. Definition

Several researches have tried to clarify and systematize existing literature on BMs through systematic literature reviews (Teece, 2010; Zott et al., 2011; Lambert & Davidson, 2013; Wirtz et al., 2016; Foss & Saebi, 2017). Although there is still no generally agreed definition of the term, Wirtz et al. (2016) argue that *'the heterogenous understanding of authors from various scientific disciplines is gradually uniting into a converging business model understanding'*. This understanding is a definition of BMs describing *creation*, *delivery* and *capture* of value in an organization (Magretta, 2002; Seddon et al., 2004; Ojala & Tyrväinen, 2006; Teece, 2010; Saebi et al., 2017; Foss & Saebi, 2017).

Teece (2010) describes *creation* as assessment and fulfillment of customer needs. *Delivery* is described as how the company responds to and delivers value to customers. Finally, *capture* is described as conversion of payments into company profits. Considering this classification, this thesis is based on the following definition of a business model:

A business model is a description of how an organization creates, delivers and captures value.

In this definition, created and delivered value includes any value customers might associate with the product or service offered. Captured value relates to value for the company. Some researchers, such as Evans et al. (2017), include environmental benefits and value related to social responsibility. However, this thesis follows Teece (2010)'s definition, where captured value primarily relates to economical value.

3.1.2. Business Model Components

Building on the separation in value creation, delivery and capture, BMs can be further broken down in components. Various alternatives of such components are proposed in theory. Leading research in this field has been carried out by Teece (2010), Osterwalder & Pigneur (2010), Lindgren & Rasmussen (2013) and Wirtz et al. (2016).

TEECE

Teece (2010) describes five different elements that should be included in BM design. These are 1) the choice of technologies and features, 2) a definition of customer benefit, 3) identification of market segments, 4) confirmation of available revenue streams and 5) design mechanisms to capture value. These elements are visualized in Figure 1.

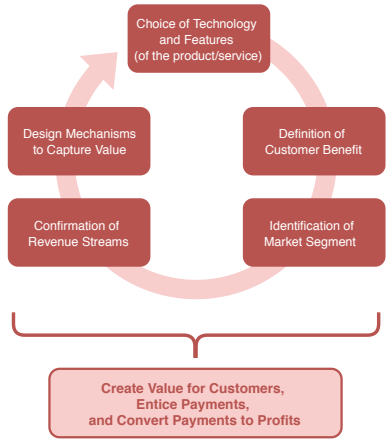


Figure 1: Elements of BM design (Teece, 2010)

The choice of technologies and features, combined with the definition of customer benefit, form the base of a company's value proposition, which is the company's core software solution. The first two elements can therefore be connected to value creation. The identification of market segments to be targeted are related to the delivery of customer value. Confirmation of available revenue streams and design mechanisms to capture value are related to capturing customer value.

OSTERWALDER & PIGNEUR

Osterwalder (2004) defines nine components, which he calls the 'building blocks' of a BM. These are presented in Table 3[1].

Table 3: Osterwalder's nine building blocks of a BM

Building Block of Business Model	**Description**
Value Proposition	A *Value Proposition* is an overall view of a company's bundle of products and services that are of value to the customer
Customer Segments	A *Customer Segment* is a segment of customers a company wants to offer value to
Distribution Channels	A *Distribution Channel* is a means of getting in touch with the customer
Customer Relationships	A *Customer Relationship* describes the kind of link a company establishes between itself and the customer
Key Activities	The *Key Activities* describe the arrangement of activities and resources that are necessary to create value for the customer
Key Resources	The *Key Resources* describe the assets required to offer and deliver the value proposition
Key Partners	A *Key Partner* is a company with which there is voluntarily initiated a cooperative agreement in order to create value for the customer
Cost Structure	The *Cost Structure* is the representation in money of all the means employed in the BM
Revenue Streams	The *Revenue Streams* describe the way a company makes money

Osterwalder's building blocks were later used by Osterwalder & Pigneur (2010) to form the *Business Model Canvas* template, presented in Figure 2. This canvas is widely used to develop new, or to document existing, BMs today, by researchers as well as business managers.

[1]Osterwalder (2004)'s list of building blocks is modified to match the defined components in the BM Canvas. The only component being significantly changed from 2004 to 2010 is the key resources component, which was originally defined as *Capabilities* in 2004.

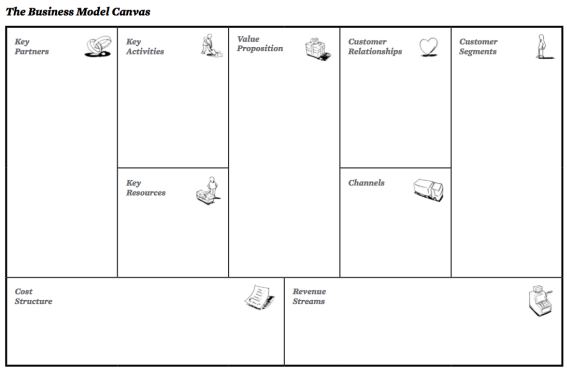


Figure 2: Business Model Canvas template (Osterwalder & Pigneur, 2010)

LINDGREN & RASMUSSEN

Through an analysis of previous BM research, Lindgren & Rasmussen (2013) try to extract the dimensions that are present in 'any' BM. The result of their research is a generic framework for working with BMs, called the *Business Model Cube*.

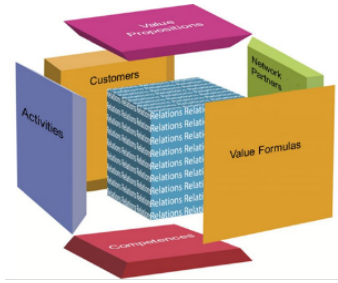


Figure 3: Business Model Cube (Lindgren & Rasmussen, 2013)

As Figure 3 visualizes, the cube consists of six plus one components. The six components are Value Proposition, Customers, Activities, Competencies, Network Partners and Value Formulas. The 'plus one'-component is placed in the middle of the cube, representing the Relations combining the other components in the middle of the cube. To verify this component breakdown, the researchers have tested the cube at several companies. Based on these tests, they claim that the seven dimensions really exist, and argue that the cube represents a general model for how any company should run its business.

The paper further argues that no business has only one BM, but applies several BMs simultaneously. Based on similarities in these BMs, such as similar customer focus, use of the same value chain or network, 'BM groups' are formed. According to Lindgren & Rasmussen (2013), these groups are often interdependent. The reasoning behind the BM groups is based on the fact that businesses do not stick strictly to their core business, and that they can apply different value propositions.

WIRTZ ET AL.

In their analysis of BM origin, development and future, Wirtz et al. (2016) perform a systematic literature review of the research field. Through a comprehensive analysis and comparison of BM research dating back to 1975, they divide a BM into nine components, and argue that all of them should be included in the model. These are further grouped into the three groups *Value Creation Components*, *Customer & Market Components* and *Strategic Components*. Figure 4 presents these groups and their associated components.

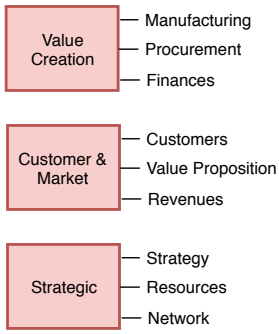


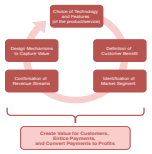
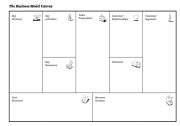
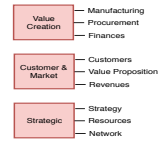
Figure 4: BM groups and components according to Wirtz et al. (2016)

OVERVIEW OF THE FOUR THEORIES

To compare the various component constellations described in theory, Table 4 is developed. The mapping of components follows Teece (2010)'s description of *creation* as assessment and fulfillment of customer needs, *delivery* as how the company responds to and delivers value to their customers, and *capture* as conversion of payments into company profits.

Some components, such as customer related components, are logical to map to the deliver category. The same applies for revenue related com-

Table 4: Overview of theory on BM components

	Teece (2010)	**Osterwalder & Pigneur (2010)**	**Lindgren & Rasmussen (2013)**	**Wirtz et al. (2016)**
				
Create	Choice of technology and features Definition of customer benefit	Value proposition Key resources Key activities Key partners	Value proposition Competencies Activities Network partners	Value proposition Resources Procurement Network Manufacturing
Deliver	Identification of market segment Confirmation of revenue streams	Customer segments Customer relationships Distribution channels	Customers	Customers
Capture	Design mechanisms to capture value	Revenue streams Cost structure	Value formulas Relations	Revenues Finances Strategy

ponents, which are mapped to the capture category. Other components can be argued to fit several of the category descriptions. One example is partnership- and network related components. Partnerships can be established for several reasons. Examples are *Research and Development*(R&D), with other companies investigating the same or similar areas, or sales related, such as with dealers and resellers. Many companies have large partner networks consisting of various types of partners. As Teece's description does not give a clear indication of which category these components should be mapped to, the mapping in Table 4 follows Osterwalder (2004)'s description in Table 3. Here, a partner is described *'a company with which there is voluntarily initiated a cooperative agreement in order to create value for*

the customer'. Based on this, partnership- and network related components are mapped to the create category.

From Table 4, it appears that the theory on BM components has been further developed and becomes more complex with time. This is logical, as the scholars presented in the table build on each other's theories. Certain components are included in all the four described theories. Therefore, it is argued that these are more important related to a company's business model than the rest. These components are, with minor literary reformulations; value proposition, resources, activities, partners, customers and revenue streams. From Table 4, it appears that four of these components are mapped to the create category. This indicates that the create category is the most complex of the three.

3.1.3. Business Model Adaptation

According to Saebi et al. (2017), *'business model adaptation'* can be defined as *"the process by which management actively aligns the firm's business model to a changing environment"*. Several recognized researchers, including Teece (2010) and McGrath (2010), emphasize the need for business models to adapt as a consequence of external impact.

A variety of external factors can cause business model adaptation. Saebi et al. (2017) mention stakeholders, regulatory forces, new technology, market-related forces and major changes in the business environment, as a few. Through studying a sample of 1196 Norwegian companies, the researchers find that firms are more likely to adapt their business models under conditions of perceived threats than opportunities. They also find that a strategy orientation towards market development is more conductive to business model adaptation compared to an orientation towards defending an existing market position.

Business model *adaptation* may be confused with business model *innovation*. Although both concepts relate to change of the business model, business model innovation is defined as *"the process by which management actively innovates the business model to disrupt market conditions"* (Saebi et al., 2017). Hence, BM innovation involves more radical changes than BM adaptation. Kaplan (2012) and Abraham (2013) also explain that business model innovation involves radical changes that often leads to completely new business models.

Although separated concepts, business model innovation might be an outcome of business model adaptation (Saebi et al., 2017). As radical changes are risky to perform without investigating the consequences in advance, Kaplan (2012) highlights changing parts of the business model at

a time. These changes may be seen as business model adaptation. In his book, *"Seizing the White Space: Business Model Innovation for Growth and Renewal"*, Johnson (2010) describes making changes in one area of a business model as an 'adjacency move'. An adjacency move does not necessarily lead to a new business model, and is therefore, by definition, not considered business model innovation. Only when a change in one area requires changes in all the other areas, a new business model is required. When this occurs, the company is moved into the 'white space' referred to in the book's title, and a business model innovation appears. Business model adaptation can therefore be seen as such an 'adjacency move': a step towards business model innovation, or a part of the business model innovation process.

3.2. Software Business Model Theory

3.2.1. Definition

Before a definition of SBMs can be presented, there is a need to define the terms *Software Companies* and *Software Solutions*. In this thesis, software companies are defined as companies developing one specific or several software solutions, either to personal customers (B2C) or to other companies (B2B).

The term software solutions encompasses in this thesis both software based products and services. Software solutions can either be used as they are when delivered to the customer, such as game applications, accounting tools and project scheduling tools. Alternatively, the solutions can be bought by other companies for further implementation. This can either be implementation in larger software solutions, or in physical tools such as cars, refrigerators, speakers, or any other physical device with a computer inside.

As there is limited theory on a definition of BMs in general, theory on a definition of SBMs in particular is even more scarce. During the fall of 2019, the author of this thesis carried out a systematic literature analysis on software business models in conjunction with the specialization project delivered in the course TIØ4562, *Strategy and International Business Development*, at NTNU. This literature analysis identified 19 articles on the subject, of which none defined the concept precisely [2]. Therefore, the definition of SBMs used in this thesis builds on the definition of BMs in general:

A software business model is a description of how a software company creates, delivers and captures value.

[2] A comprehensive list of these articles and their research contributions is presented in Appendix A

3.2.2. Software Business Model Components

The literary analysis of 19 SBM articles revealed that the five most thoroughly described SBM components related to software companies are value proposition, activities, customer relationships, revenue streams and resources, in this order. This is illustrated in Figure 5 below. The mapping of components covered in specific articles can be found in Appendix B.

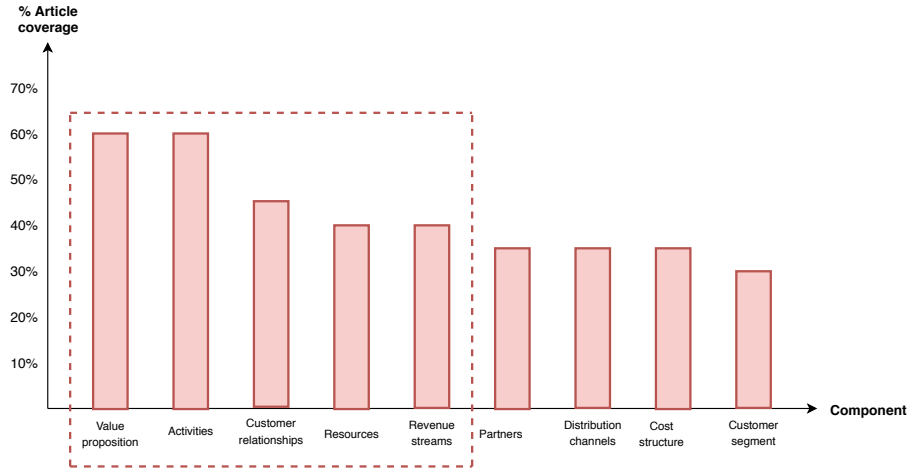


Figure 5: SBM components covered in literary analysis

Theory on BMs in general also highlighted these five components as particularly important. In addition, this assessment included the partners component. This implies that there is a possibility of the partners component being more important in SBMs than what is evident from Figure 5. Therefore, the six components value proposition, resources, activities, partners, customers[3], and revenue streams will be included in further assessment of BM theory specifically for software companies.

Based on the above assessment, combined with the mapping in Table 4, Figure 6 is created. This Figure shows the order in which the six components will be further presented.

[3]As the type of customer *relationships* often depend on *segment*, the component name is rephrased to *customers* to encompass both customer segments and relationships

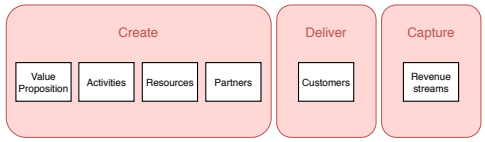


Figure 6: Overview of the SBM components

VALUE PROPOSITION

SaaP vs SaaS. Several researchers separate Software as a Product (SaaP) and Software as a Service (SaaS) as two types of software company offerings (Popp, 2011; Rebsdorf & Hedman, 2014).

Offering SaaP, the company delivers a copy of the software to the customer, which runs on the customers' servers as long as the customer wishes. (Popp, 2011). After software delivery, the customer carries the cost for the usage rights, support, maintenance and operations. An example is Microsoft and their previous Microsoft Office offerings, where the customers had to buy a whole new product upon release of an updated version.

When delivering SaaS, or *Cloud-based Services*, the software vendor does not give away the software, only access and usage rights. The software vendor carries the cost of software support, maintenance and operation (Popp, 2011). As the service is hosted online, it does not require any customer installation of software (Wasserman, 2011). Examples of hosted SaaS applications include email, personal productivity, office automation, customer relationship management, software development, online communities, conferencing and games.

In the past years, several companies have developed from only offering SaaP to offering an increasing degree of SaaS. Researchers emphasize that this movement requires significant changes in the company's BM (Popp, 2011; Rebsdorf & Hedman, 2014). These changes are particularly related to development, maintenance and support processes. An example of a company developing to offer an increasing degree of SaaS is the leading Nordic ERP systems provider Visma. The drivers for Visma's SaaS strategy were based on a combination of market expectations and technological opportunity (Rebsdorf & Hedman, 2014). Popp (2011) supports that a changing business environment facilitates an increase in SaaS offerings, to exploit new opportunities and customer needs.

Customized vs Standardized. In addition to the choice between offering SaaP or SaaS (or both), the majority of the articles in the literature analysis highlight the importance of the degree of customization related to their product offering (Rajala et al., 2003; Engelhardt, 2004; Sainio & Marjakoski,

2009). The reason for this is that this choice has major implications on a significant part of the other BM components, including key activities, customer relationships, distribution channel and revenue model.

Customized software products are tailored to meet specific customer needs. According to Sainio & Marjakoski (2009), customized value propositions are characterized by being difficult to scale and resource consuming, but they have high potential of satisfying customer needs. Engelhardt (2004) finds in his studies of German software companies that customized product developers were the most successful of the two in the beginning of the 2000's. However, Rajala et al. (2003) state that complicated functionality and big organizational impact imply more interaction with the potential customer, which drives up the cost of sales.

Standardized value proposition has a low degree of customization, and is characterized by being easy to duplicate and resource efficient. Rajala et al. (2003) claim that low prices and short sales cycles, which typically characterize standardized products, enable software companies to use low cost sales channels. In addition, standardized products offer opportunities to benefit from positive network effects and to extend the business outside the primary market segment. In their case study of two Danish ERP vendors, Antero & Bjørn-Andersen (2013) find that a software product does not have to be rare or non-substitutable to be successful, as long as it can offer value for potential customers. This further strengthens the motivation to offer standardized products.

Modular solutions. In between standardized and customized value offerings, there exist several propositions that combine the two categories. Rajala et al. (2003) distinguish between standardization and customization as two extremes in their software product categorization, and places modular solutions between the two. Modular software solutions are built up of various modules, of which some can be standardized, and other customized.

Increased hybridization. In their study based on both survey data and longitudinal case studies, Willemstein et al. (2007) find an increased hybridization of the value proposition as companies evolve. From offering one single core solution, which can be either a product, platform *or* service offering, companies develop an offering hybrid solutions of these, during a time span of two to seven years. Further, the researchers find that this development occurs as a consequence of what they call 'shifts in business models'. The timing of several of these shifts are directly related to technological development in terms of new technology that is ready for production.

Product portfolios. Many software companies offer product portfolios consisting of additional offerings to the core product. This can either be

additional features, or a whole line of different products and services, such as advertisement space, work effort (product courses) and hardware products (Rajala et al., 2003; Riemer, 2010). Like Visma illustrates, companies can offer both SaaP and SaaS solutions. Software companies are typically established based on one core product, and expand their product portfolio as they evolve to be more established.

ACTIVITIES

In the initial phase of a software company's life, the main activities are R&D related to the core software solution. After the company has started selling this, additional activities related to sales and business development take place.

Traditionally, the dominant model for software development has been a co-located team of people responsible for the concept, design, development, testing and ongoing maintenance of the software solution (Wasserman, 2011). This model is disrupted by technology introducing new collaboration and development tools, which enables various forms of global working environments (Wasserman, 2011). Today, various ways of software development are applied in practice. A selection of different software development models that were identified through the literary analysis are presented in Table 5.

The choice of the appropriate development model is tightly connected to the value proposition. Many software products are built using a modular architecture. This facilitates grouping together, separating or locking in key features, enabling hybrid alternatives of the different models presented above. Some parts of the software assets can be outsourced, publicly shared or shared with partners, whereas others are kept internally in the organization or a specific system group.

Although software development can be done in several ways, some principles apply regardless of choice of development model. Al-Fedaghi (2014) emphasizes the importance of thorough requirements specification and internal communication. However, Melegati et al. (2019) point out the fact that because software companies often create brand-new products or services, requirements are difficult to gather and highly volatile. Hienerth et al. (2011) and Heaton et al. (2016) highlight continuous learning from previous projects to address core issues as specifically important in software development.

Table 5: Software development models

Development model	Description
In-house	The customer buys the whole product as it is, and receives unlimited use. This implies that when an updated product is released, the customer has to buy the new product to use the latest features developed by the software company itself.
Partnering	The software company collaborates with one, or several, other software companies in code development.
Open Source Software (OSS)	The software company releases the source code, enabling users to change the code, and contribute to improve the software solution. The Open Source Initiative (OSI) ensures quality of the released OSS developed software, despite the fact that the background of many of the software contributors is unknown (Wasserman, 2011). Characteristics common for OSS models are shared costs and risks with a larger user community (Wesselius, 2008). Examples of products that are dominant in the OSS field include the Linux operating system, the Firefox browser and the Eclipse development environment.
Inner Source Software (ISS)	ISS can be viewed as a restricted form of OSS, where software assets are only shared internally in the organization. This model is particularly applicable for large organizations, as these are likely to develop different products partly relying on the same software code (Wesselius, 2008). Philips Healthcare is an example of a company that successfully exploits ISS.
Crowdsourcing	The software company exploits external sourcing of digital content to their own products (Bergvall-Kåreborn & Howcroft, 2013). This content is not direct source code writing as in OSS development, but it relies on the software solution offered by the software company. Apple is a success example of a company that exploited this development model to gain dominance in the global mobile telephone market.
Outsourcing	The software company hires another software development company to be responsible for new applications development, enhancement or maintenance of existing applications (Rajkumar & Mani, 2001). Typically, companies outsource development of more standardized parts of the code to countries with lower labour cost. Outsourcing is also done to software development companies with specific competence that the outsourcing company does not obtain themselves.

RESOURCES

A software company's *resources* are in this article defined to include the software company's assets, capabilities, organizational processes, knowledge, information and attributes (Antero & Bjørn-Andersen, 2013; Barney, 2000). Employee competence, intellectual property and partner networks stand out as important resources for software companies.

Employee competence. Rebsdorf & Hedman (2014) describe technology and employees as the main resources of a software company. They claim that technology resources are likely to be purchased from the factor markets, while employee resources may prove more difficult to obtain. According to Arthur (1996), software companies are characterized by being heavy on know-how and lit on resources. As software development is a highly knowledge-intensive process, labour knowledge is evaluated as the

most valuable resource of a software developing company. This knowledge can be related to several different areas, including technical, innovative, managerial and customer oriented knowledge. This implies that the primary concern related to resources for software development companies, is associated with hiring and keeping valuable employees.

In relation to attracting and hiring competent employees, Antero & Bjørn-Andersen (2013) mention Maconomy's establishment of the 'Maconomy Academy', where young engineers learned to use Maconomy's software tools, as a clever move to attract competent employees. However, except from this example, there is limited focus in the literature review on how to attract knowledge-intensive labour, and how to keep it. In fact, there is very limited focus on HR in general.

Intellectual property. Building on employee competence, *Intellectual Property* (IP) is evaluated as an important resource for software companies. IP can be defined as intangible assets a software company has created as a result of combined knowledge and creativity. A software company's IP can be protected through patents and copyrights. As patenting is costly for companies at early stages, Mets et al. (2010) argue that in case of software, the best strategy can be the utilisation of copyright and trade secret protection to protect the company's IP resources. Melegati et al. (2019) emphasize that benefits from a restrictive IP policy include blocking competitors and easier access to funding from venture capitalists and technological institutions. Skype, Asper and Icosagen are examples of companies that have used patenting for either blocking their competition or guaranteeing freedom to operate for themselves.

Partner networks. Rajala & Westerlund (2007) include partner networks and exploitation of knowledge intensive services outside company boundaries as important resources. Antero & Bjørn-Andersen (2013) build on this by arguing that when applying collaborative partnerships, a resource can be these partners' knowledge in areas where the software companies themselves lack competence, experience or capacity. Examples are knowledge of local markets, and larger distribution and sales capacity.

PARTNERS

Having a unique and non-substitutable partner ecosystem can be the key to success (Antero & Bjørn-Andersen, 2013). Rajala & Westerlund (2007) substantiate on partner benefits by stating that knowledge intensive services can be acquired from partners in networks, and further lead to strategic and future-oriented new-business development.

Antero & Bjørn-Andersen (2013) claim that technology will lead to in-

creased intermediation and inclusion of more economic units in the traditional value chain or value network of software companies. The main reasons for this are lower transaction costs and increased focus on core competences. Rajala et al. (2003) support this view by highlighting the extensive and increasing cooperation between software business in different networks.

In Table 6, various types of partnerships deployed by software companies are presented. These types of partnerships are found through the literary analysis.

Table 6: Software partnership models

Development model	**Description**
Resellers	A reseller buys the software company's solution and sells it at a higher price.
Strategic Partnerships	A strategic partnership with another business actor can have various forms related to development, distribution, and sales & marketing activities. The case companies in the literature review indicate that strategic partnerships are seldom planned in advance. An example is that when Damgaard Data A/S emerged as a strong competitor of the Danish ERP vendor Navision, the two companies partnered to combine their strengths and knowledge. Another example is Visma. When an opportunity has occured, Visma has partnered with (and acquired) many software companies developing innovative solutions Visma could benefit from. This implies that if the BM is suited for a collaboration partnership with another company, this may happen by capturing opportunities as the company evolves.
Customers	'User innovators' and user-centric BMs show how customers can be essential partners through involvement in various core business processes. User innovators and user-centric BMs will be described related to the customers component.
Financial Partnerships	Rajala et al. (2003) and Engelhardt (2004) both emphasize the movement of software developing companies from taking loans in the bank, to rather receiving funding from stakeholders in order to reduce economic risk. These stakeholders can be viewed as financial partners, and can be both individuals or other companies. Shareholders can also be viewed as financial partners. Melegati et al. (2019) identify a decrease in founders and early investor's influence as software startups mature. Engelhardt (2004) finds that being listed on a stock market in the beginning of the 2000's enhanced the success of software developing companies.

Antero & Bjørn-Andersen (2013) find that that positive effects of resellers and partnerships with other software developers include economies of scale, local knowledge when expanding to new countries (including language, legal and other requirements), and shared costs and risk of system sales and implementation. This finding is based on an historical analysis of two Danish ERP vendors, Maconomy and Navision. In this analysis, they find that Navision, who relied on resellers and strategic partnerships in their sales and services activities, outperformed Maconomy, who was responsible for all parts of its own value chain.

CUSTOMERS

Melegati et al. (2019) state that a natural classification for company-user relationships is a division between business-to-consumer (B2C) and business-to-business (B2B). This is the classification used in marketing and operation studies (Melegati et al., 2019).

Battistella et al. (2019) emphasize that the development of digital platforms based on blogs, forums and wikis, has stimulated the contribution 'user innovators'. User innovators are customers who are interested not only in the use and consumption of a product/service, but also in its production. Hienerth et al. (2011) focus on the importance of *User-centric business models* in their description of customers related to SBMs. In user-centric models, the users themselves drive value by being involved in the core business processes of new product development, production and marketing, and the value proposition is co-created by the users and the company through interaction. This importance is illustrated through LEGO's exploitation of the user-centric model. When LEGO launched an open collaboration platform in 2005, this resulted in the creation of the game *Mindstorms*, which is a combination of a physical and virtual product. Mindstorms is built of traditional LEGO bricks, and the customer can make these bricks move through programming. The product would never have developed without inclusion of customers. This inclusion even made the product a success for customers in the age group 18+, which were not LEGO's targeted customer segment in the first place.

Hienerth et al. (2011) also find positive results when investigating how the companies IBM and Coloplast have applied user-centric models. Based on these results, the researchers encourage inclusion of customers and exploitation of their creative potential. However, they highlight several factors that are necessary to successfully implement a user centric BM. These factors include a suitable social software design, a transparent IP policy, proper incentive systems, evolutional learning and employee empowerment. Wiederhold et al. (2010) support that inclusion of customers in development activities has a direct impact on the IP policy of the company.

Drew (2015) highlights the importance of software companies' ability to adapt to customer needs and environment changes through the current development of the accounting industry. This industry is in rapid growth, evident through automation of standardized tasks and the growing portion of data exploitation and offered consulting services, which provides great opportunities for software companies related to development and delivery of supporting tools. Drew (2015) concludes that the rapid technology development leads to rapid change in customer needs, which will continue to

increase customer relationship importance related to offerings of software services.

REVENUE STREAMS

As companies need to be profitable to survive, revenue streams are in this thesis limited to describe potential continuous sources of income. Funding is essential in the initial phases of a software company's life. However, this is not considered a continuous revenue stream.

Theory indicates two key factors that must be defined for software companies to capitalize on their value proposition. These are the *revenue model* and the *price charged* (Sainio & Marjakoski, 2009). On a high (strategic) level, the software company needs to decide on the revenue model. This relates to *how* a company capitalizes on its value proposition, including where payments come from, and how often. On a lower (operational) level, it needs to decide on the price charged. This relates to *how much* the software company capitalizes on its value proposition.

Revenue model. Related to the revenue model, technological development has enabled several new possible revenue models (McGrath, 2010). Several of these models are particularly applicable for software companies. In Table 7, eleven different revenue models that have been identified through the literature review are described. The descriptions are based on theory from various researchers, including Rajala et al. (2003), Ojala & Tyrväinen (2006), Wesselius (2008), Sainio & Marjakoski (2009), McGrath (2010), Popp (2011), Antero & Bjørn-Andersen (2013) and Niculescu & Wu (2014).

Table 7: Software revenue models

Revenue Model	Description
One-time Purchase	The customer buys the whole product as it is, and receives unlimited use. This implies that when an updated product is released, the customer has to buy the new product to use the latest features developed by the software company itself.
License Based	The customer pays for the rights to use the software tool for a specified time interval. The license can either include or exclude additional services.
Subscription Based	As in the license based model, the customer pays for the rights to use the software tool for a specified time interval. However the subscription time intervals are usually shorter, which implies regular and more frequent payments. This model often includes a binding time the customer has to subscribe.
Freemium (Feature based)	The software company offers both free and premium alternatives. Premium features can be based on storage capacity, number of simultaneous users, no commercials, number of projects, numbers of transactions, etc. The media-services provider Spotify uses this revenue model and allows the customer to listen to music for free with commercial breaks, or pay a monthly fee for the premium version, skipping the commercials. The online game Fortnight is also based on a freemium model as it offers gaming functionality for free, but charges customers for virtual gadgets that enhances the gaming experience.

Continued on next page

Table 7 – *Continued from previous page*

Revenue Model	Description
Freemium (Time based)	Freemium models can also be based on time. In this case, the software company offers customers complete product functionality for a limited period of time. After that, customers pay a monthly fee. A product exploiting this model is Adobe Photoshop, where customers can download a 7-day free trial before they take a monthly fee.
Revenue Sharing	The software company's revenues depend on their customer's benefits associated with the software delivery. Revenues can be based on usage of the software, royalties per sold device of a customer company (if the customer produces devices using the software), or they can be defined as a percentage of the customers income related to the software delivery.
Indirect Revenue	Indirect revenue is obtained when the software company's income does not come from the users of the software product. It can be obtained in various ways. The most common way is advertising, where products can be totally free for the end customer, because the software company gathers revenue from advertising companies. Examples are mobile applications such as Instagram and Snapchat.
Loss-leader Pricing	Loss-leader Pricing means selling the value proposition for less than its value. This can be done through a discounted price, for instance to a specific customer base, at an event or for a restricted amount of time.
Uniform Seeding (Software solutions)	The software company offers the solution for free to a *percentage* of the addressable market *uniformly* across consumer types. Thee goal is to enhance sales through network and word of mouth effects. An example of a company exploting this model, is the Norwegian paper tablet provider Remarkable. A more comprehensive example is the Danish ERP vendor Maconomy, who established a Maconomy Academy at the Technical University of Denmark, where they allowed young engineers to use the Maconomy tools. Giving the software product to academic institutions ensures that students get familiar with product functionality and potential, which can increase the chance of product usage in companies and corporations after the students graduate.
Uniform Seeding (Other products/ services)	The software company can also give out other things than the software solution, both tangibles and intangibles. To be categorized as uniform seeding *uniformly*, these offerings should be offered for free across consumer types. Examples of tangibles include general merchandise (T-shirts, tote bags, lunchboxes etc.) with the company logo, or books and magazines which can explain product functionality. Intangibles can be courses, workshops and lectures held by the software company, to enhance customer knowledge and interest and further encourage product sales.
Multiple Revenue Streams	A combination of two or more of the above mentioned models. Flickr applies a multiple revenue stream model, which involves collecting subscription fees, charging advertisers for contextual advertising, and receiving revenue-sharing fees from partnerships with retail chains and complementary photo service companies.

Price charged. When it comes to deciding on the price charged, traditional pricing models are divided in three categories, namely cost-, market- and value based pricing.

Cost based pricing can be difficult to apply for software companies delivering standardized products. The reason for this is that these companies usually have significant up-front costs compared to marginal sales. However, cost based models are easier to apply when it comes to customized value proposals, where working hours can be directly linked to customers (Sainio & Marjakoski, 2009). The price charged can be based on the number of worked hours in the project, which implies payments in retrospect,

or definition of a dedicated workforce for a specified period of time. In the latter, payments can either be made in retrospect or in advance.

Market pricing is deciding the price charged based on the price of similar offerings in the market. As many software companies have unique service offerings, this method can be difficult to deploy.

As cost based pricing is difficult for standardized products, and market based pricing is difficult for all software projects without comparable competitive solutions, value based pricing is considered to be the optimal way to decide on the price charged for most software developers. This is supported by Sainio & Marjakoski (2009). They find that software companies are highly aware of their core competence in terms of technology and ideas, and suggest that revenue logic should be based on company know-how, and how this know-how can be further developed to meet the current trends of an increasing service orientation.

Niculescu & Wu (2014) support value based pricing, and state that the choice of revenue model should be based on perceived customer value. A challenge related to this, is however that many software products are 'experience goods'. Only upon testing the solution, customers can get a real impression of the product value, and what they are willing to pay (Niculescu & Wu, 2014). To assess customer value before the initial pricing, companies can test their solutions on their targeted user base, and gather feedback.

Considering all these options, both related to the choice of revenue model and the price charged, how should the software company decide on the best fit?

Five factors that impact the answer of this question are 1) the movement from SaaP to SaaS offerings, 2) the distinction between customized and standardized solutions, 3) the customers value perception of the product, 4) the influence of network effects and 5) the risk associated with product development. The two first factors depend on the value proposition, while the other three depend on external stakeholders such as users and product partners.

Table 8 illustrates which revenue models and price strategies that were assessed as suitable given the influencing factors. Below, the reasoning behind these propositions are explained.

1) Movement from SaaP to SaaS. Several researchers emphasize the change in revenue model associated with the general movement from SaaP to SaaS offerings. Rebsdorf & Hedman (2014) point at changes from long-term licensing to subscription and usage-based fees, as well as the responsibility of the SaaS vendor for the full SaaS delivery from development to service operations and extended support. Wasserman (2011) illustrates this

Table 8: Factors influencing choice of revenue streams

Associated component	**Influencing factor**	**Suitable revenue model**	**Suitable basis for price charged**
Value proposition	SaaP	- License based	- Value based (excl. extra services)
	SaaS	- Subscription based	- Value based (incl. extra services) - Market based (when comparable products in market)
Value proposition	Customized	- One-time purchase - License based - Revenue sharing	- Value based
	Standardized	- License based - Subscription based	- Value based
Customers	High value perception	- Freemium - One-time purchase - License based - Subscription based	- Value based (Price skimming strategy)
	Low value perception	- Uniform seeding	- Value based (Penetration pricing)
No specific	High network effects	*No specific*	- Value based (Penetration pricing) - Higher price level
	Low network effects	*No specific*	- Value based - Lower price level
No specific	High risk	- Revenue sharing	*No specific*

exact movement by using Microsoft as an example. Microsoft had for a long time sold Microsoft Office as SaaP, but was forced to shift to less expensive and less feature-rich home and student edition of Office, as well as development of a hosted service, Live.com, for editing of documents compliant with the Office file formats. The movement from traditional one-time and licence-based purchase based revenue models to subscription-based models is supported by Rajala et al. (2003) and Ojala & Tyrväinen (2006).

2) Customized vs standardized. Sainio & Marjakoski (2009) use the distinction between customized and standardized value propositions as a starting point for deciding both the revenue model and the price level. Based on 23 interviews with representatives from Finnish software companies, they

argue that for customized propositions, the preferred revenue model is a specified deal with the customer, which can be part of a one-time purchase or license based model. In addition, revenue sharing can be considered. Factors that influence the price level of customized products include responsibilities during and after the project, start of the deal, phases of the project, sales and marketing, consulting, as well as costs of maintenance, resources and coverage. Related to standardized propositions, Sainio & Marjakoski (2009) find that licensing or subscription based on a fixed period of time or the number of users is favorable. Factors influencing the price level include subscription/ license content, rights and updates, the software company's own sales, marketing and distribution costs, as well as costs of maintenance, resources and coverage.

3) Customer value perception. In their comparison of different revenue models, Niculescu & Wu (2014) find that when perceived value of the solution is high, software companies should apply either a freemium model or one of the models where the software company 'charges for everything', which includes the one-time purchase, license and subscription based models. However, if customers underestimate the value of functionality, the software company should apply uniform seeding, and give a percentage of the selected market the product for free. Regarding the price level in one-time purchase offerings, they find that in higher initial valuation scenarios, a price skimming strategy is preferred, while lower initial valuation scenarios should be approached using penetration pricing.

4) Network effects. Arthur (1996) and Engelhardt (2004) highlight that network effects represent an important feature related to revenue streams. These effects imply that product value increases when it becomes more widespread and established. This is a result of greater expected degree of compatibility with other software systems, as well as interoperability with other users. It is argued that both B2B and B2C customers are more likely to choose the predominant product if exposed to high network effects. According to Niculescu & Wu (2014) value based pricing based on penetration pricing is found to be favourable when network effects are present.

5) Risk level. Ojala & Tyrväinen (2006) find that a revenue-sharing model can be favorable involving longer value chains or a bigger stake in the project.

CONNECTING THE COMPONENTS

Although the components are described separately in this section, it is essential to keep in mind that they are highly intertwined and dependent on each other. For instance, partners, which is a component in itself, are evaluated

as an important resource related to the resources component. Customers, which also represent a defined component, are described as a type of partner.

In addition, the type of revenue streams depend on type of value proposition; both the degree of standardization/ customization, and whether the value proposition is a SaaP or a SaaS offering. Both revenue streams and development of the value proposition depend on customer perceptions and network effects, which includes customers and partners.

In return, the choice of revenue model can impact customer relationships. For instance, Rebsdorf & Hedman (2014) find that the change in revenue models from one-time purchases to continuous payments has led to software vendors not just shipping a product to a customer and taking the payment anymore. Instead, sales relationships last over a long period after the initial purchase. These component interrelations are important to keep in mind in further discussion of SBM components in this thesis.

How such internal SBM interrelations connect the six components is visualized in Figure 7. The interrelations are visualized through back and forth-arrows.

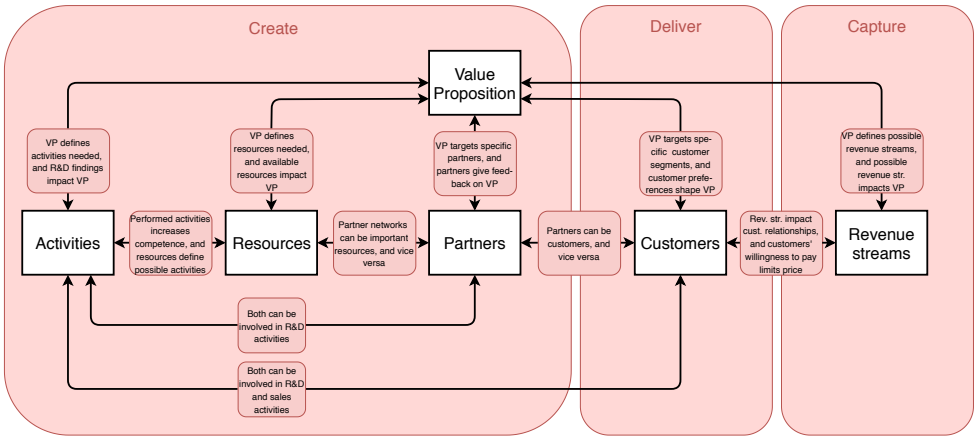


Figure 7: Interrelations between the SBM components

From the figure, it appears that the value proposition component impacts all the other five components in some way, and that all these components influence the VP in return. This illustrate the importance of the VP component in a software company's business model.

3.2.3. Software Business Model Adaptation

Some scholars, including Popp (2011) and Sainio & Marjakoski (2009), highlight the importance of *software* companies in particular to continuously adapt their SBMs to a changing business environment. However, as theory related to software business models is limited, theory related specifically to *adaptation* of these models is even more scarce.

To discover new, favorable models, McGrath (2010) emphasize that as new business models emerge, all companies must continuously engage in significant experimentation and learning. Popp (2011) supports this by enhancing that *software* companies can leverage successful companies' business and revenue models to create competitive advantage.

Drew (2015) highlights the need of foresight for software companies to be able to adapt and exploit new markets. As the accounting industry faces enormous changes, evident through an increased share of consulting services, value based pricing and data based knowledge, this industry is used as en example where foresight is essential. Drew (2015) claims that software companies have a high potential of exploiting such trends in other industries as well, through development and delivery of services related to automation, data access and analysis.

When it comes to the process of how BM adaptation occurs, Andries & Debackere (2006) find that in new technology companies, it consists of different episodes, characterized by uncertainty or ambiguity. Willemstein et al. (2007) also finds that SBM adaptations occur due to external 'shifts', which takes place every few years.

To facilitate business model adaptation, several tools and frameworks have been developed. One example is the 'Wheel of Business Model Reinvention'. This is developed by Voelpel et al. (2004), and shows that BM innovation goes through four 'dimensions' in a cycle. These four dimensions are customers, technology, business system infrastructure and profitability. The cyclical adaptations in these four dimensions, which occur over and over again, is argued to lead to BM innovation.

Another tool for adaptation, developed for software business models specifically, is the '4C Typology' developed by Wirtz et al. (2010). This tool investigates the impact of external factors related a wave of changes on the internet, referred as 'Internet 2.0', on four different types of business models. Wirtz et al. (2010) find in their study that of the four business models, the models exploiting user engagement were impacted most by Internet 2.0.

A third tool for BM adaptation, also for technology-based companies in particular, is the 'Dynamic Business Model Framework'. This framework is developed by de Reuver et al. (2009), and is based on a longitudinal

study of 45 case companies in various industries. It shows how much technological, market and regulatory factors impact the business model in the various phases of the technology company's life. These phases are R&D, implementation and commercial phase. The researchers find that impact of technological and market-related factors is particularly influencing in the R&D phase, and continues to be highly influential in the two other phases. Despite the researchers' expectations, impact of regulatory factors was found to be low in all three phases.

Although the importance of continuous adaptation is emphasized, there is limited theory describing which parts of the SBM that are most prone to adaptation, and how these parts should be adapted as a consequence of external factors.

3.3. Summary of Theoretical Background

Scholars investigating business models apply various definitions and interpretations of the term. Still, there seems to be a general agreement that a company's BM describes how the company creates, delivers and captures value. Therefore, this thesis is based on this definition, and business models of software companies are defined as *'A description of how a software company creates, delivers and captures value'*.

In theory, business models are often divided in several components. For companies developing software products in particular, six components appear as particularly important. Related to creation of value, these components are the value proposition, resources, activities and partners. Related to delivery of value, the customers component is essential. When it comes to capturing value, revenue streams is evaluated as the most important component.

Business model adaptation are changes in parts of the software business models, to align these models with the external environment. BM adaptation be seen as a step towards business model innovation. The 'parts' that are changed can be viewed as the various business model components. Particularly related to adaptation of software business models, continuous development through experimentation, leverage of successful companies' models as well as foresight is emphasized.

4. Methodology

To answer the problem statement in this study, a qualitative research based on a multiple-case study design method has been carried out and compared to the described theory. This section presents in detail the methodology for this research process and explains the reasoning behind the choice of research approach.

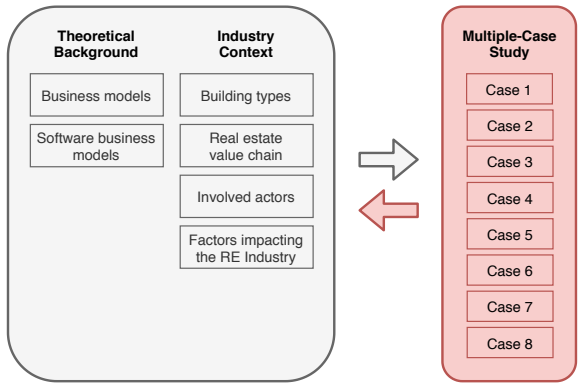


Figure 8: Framework of analysis

An overview of the design method is presented in Figure 8. Firstly, theoretical information on business models in general, as well as on software business models in particular, is gathered. Secondly, information related to the case industry context, which in this thesis is the real estate industry, is collected. Thirdly, an interview guide is developed based on theoretical findings and the industry context, and eight case companies operating in this industry are interviewed. These interviews are further transcribed and analysed in a cross-case analysis, presented in Section 6. Lastly, as the grey and red arrows illustrate, the empirical findings from the multiple-case study are discussed and compared to theoretical findings from the existing theory on the field, put in the industry context. This discussion is found in Section 7.

4.1. Theoretical Background

To contribute to research on SBMs, it is essential to gain and understanding of how far theoretical research on the field has come today. As there is limited academic research on SBMs in particular, theory on BMs in general is gathered to complement the theoretical foundation of the thesis.

The theoretical background on BMs in general is based on a selection of heavily cited articles, written by recognized scholars in the field. Number of citations range from 473 (Foss & Saebi, 2017) to 6496 (Teece, 2010) according to Google Scholar (Googlescholar, 2019). The articles are published in highly ranked academic journals such as Long Range Planning, Journal of Management, and Business Strategy and the Environment (Scimago, 2019). Some of the articles, such as those written by Wirtz et al. (2016) and Foss & Saebi (2017), perform comprehensive analyses of existing BM theory and previous research.

The foundation for theory on SBMs in particular, is primarily based on a comprehensive systematic literature analysis on software business models, which was carried out by the author of this thesis the fall of 2019. This analysis focused particularly on SBM components and interrelations, and was the central part of the specialization project delivered in the course TIØ4562, *Strategy and International Business Development*, at NTNU in Trondheim. The literature analysis resulted in 19 articles on SBMs, which are presented in Appendix A. These articles were found through the databases Scopus, Business Source Complete (EBSCO) and Oria. Several requirements were applied in the database searches to ensure quality, as well as a distinct focus on business models of software companies, in the assessed theory. For instance, only peer-reviewed articles, by other scholars working in the same field, were included. Also, search techniques such as use of phrase signs were applied in the search process, to ensure a consistent article focus.

As the primary focus in the 19 articles found in the literature analysis was on SBM components and interrelations, additional theory was assessed related to SBM adaptation. This theory was found through direct searches and snowballing, where the number of citations and the publishers' recognition were evaluated to ensure research quality.

4.2. Case Context

The case context in this thesis is the real estate industry. Information on this field is gathered through news articles and industry research reports. These reports are developed by large organizations and enterprises with activities within the RE industry, or initiated through academic institutions. An overview of the industry reports is presented in Table 9 below.

Table 9: Overview of industry reports on the RE industry

Responsible Company/ Institution	**Title**	**Authors**	**Year**
BI Norwegian Business School	En verdiskapende bygg-, anlegg- og eiendomsnæring (BAE): Oppdatering 2019	Lena E. Bygballe, Gjermund Grimsby, Bettina Eileen Engebretsen and Torger Reve	2019
International Finance Corporation (IFC) and Carbon Pricing Leadership Coalition (CPLC)	Construction industry value chain - How companies are using carbon pricing to address climate risk and find new opportunities	N/A	2018
Malling & Co	Proptech og forvaltning av næringseiendom	N/A	2019
McKinsey & Company	Seizing opportunity in today's construction technology ecosystem	Jose Luis Blanco, Andrew Mullin, Kaustubh Pandya, Matthew Parsons and Maria Joao Ribeirinho	2018
PwC and The Urban LandInstitute (ULI)	Emerging Trends in Real Estate® Europe 2020	N/A	2019
Skanska AB	Skanska annual and sustainability report 2019	N/A	2019
Statistics Norway (SSB)	This is Norway 2019	Ingrid Modig	2019

4.3. Case Study Approach

In this subsection, characteristics of the chosen multiple-case research method, as well as criteria for the selected case-companies, is presented. Further, the subsection describes how the empirical data used in this thesis is collected and analysed.

4.3.1. Selection of the Multiple-Case Research Method

According to Yin (2009), the type of case-study method used can be defined as a *holistic multiple-case design*. In a multiple-case design, the same study is performed on more than a single case. The term *holistic* indicates that the various case-studies do *not* include additional collection and analysis of quantitative data within each case. If so, the design would have been described as an *embedded* multiple-case design (Yin, 2009). When applying a multiple-case design, Yin (2009) recommends *replication* to facilitate comparison of either similar or contrasting results. As all the eight case companies are asked the same questions in the interviews, and all interviews have lasted approximately one hour, this recommendation has been followed.

Herriott & Firestone (1983) emphasize the method's ability to generalize while at the same time preserving in-depth descriptions. By addressing the same research question in a number of settings using similar data collection and analysis procedures, the researchers claim that the multiple-case method seeks to permit cross-site comparison without necessarily sacrificing within-site understanding. Based on this, they evaluate the multiple-case method as a robust research method. As all interviewees are asked the same questions, and various follow-up questions have been applied in the different interviews to investigate interesting aspects, the method applied is considered to permit comparison without sacrificing unique case understandings, which ensures robustness according to Herriott & Firestone (1983).

There are several reasons behind the choice of performing a multiple-case design study for this thesis. Firstly, Yin (2009) claims that this approach is preferable when the research questions seek to explain some present circumstance. As it is argued that adaptation of software business models is of essential importance for managers of software companies today, the multiple-case study method is applicable. In addition, Yin (2009) highlights that the case study method is applicable related to in depth descriptions of social phenomenons. All the impacting trends evaluated, including technological, social and trends related to environmental sustainability, can be seen as results of social phenomena. This supports the choice of the multiple-case method.

By following Bryman (2016)'s definitions, the design method applied in this thesis can also be described as a *comparative* design method. According to Bryman (2016), a multiple-case study occurs whenever the number of cases examined exceeds one. When these single-case studies are combined, a comparative design method is performed. Bryman (2016) further emphasizes that case studies usually have an *idiographic* approach, where the researcher is concerned to reveal unique features of the case. As the thesis aims to strengthen the theory related to adaptation of SBMs, including the variety in these adaptations, the comparative design method should be appropriate in this assignment.

4.3.2. Case Selection Criteria

According to Bryman (2016), the cases used in a multiple-case study should be chosen either because they represent a broader category of cases, or because they will provide a suitable context for certain research questions to be answered. In this thesis, emphasis is put on ensuring a suitable case context. This is established through the selection of a group of case companies with a certain degree of similarity. This similarity is ensured by

all case companies fulfilling the criteria below:

- The company should offer software solutions
- The company should have a defined value proposition
- The company should be founded in Norway
- The company should operate in Norway today
- The company should have customers within the real estate industry, directly or indirectly
- The company should have less than 50 employees
- The company should have either an annual turnover below 10 million euro and/or an annual balance sheet total below 10 million euro
- The company should be younger than 10 years old

As all case companies offer software solutions, they can be defined as *software companies* according to the definitions described Table 2. By having defined value propositions which they create and deliver to customers, in addition to capture value for the company itself, all case companies have some form of an SBM. Further, by operating in Norway, all companies are exposed to external factors including technological development, societal trends and an increased environmental focus. In addition, they are all affected by the corona situation turning the country upside down during the spring of 2020. This makes all case companies relevant for answering the research questions in the study.

Through limiting the selection of software companies to companies targeting the real estate industry, a homogeneous case selection is ensured. The choice of one industry in general, is made to increase similarity between the case companies, and hence facilitate comparison between the various objects in the study. The choice of the real estate industry in particular, is based on the fact that this is a market influenced and changed by technological development, societal trends and increased environmental focus at a high pace today (Skanska, 2019). This offer great opportunities for software companies targeting the RE sector. To exploit these opportunities, adaptations of the software companies' BMs are made.

All case companies included in this thesis can be defined as *small* companies according to the European Commission's definition. This definition states that small companies have less than 50 employees, and they have either an annual turnover below 10 million EUR and/or an annual balance sheet total below 10 million EUR (EU, 2012). As small companies often

are young companies, an age limit of ten years has been defined to further ensure case similarity.

There are several reasons for targeting small and young companies in the case study. Firstly, it is assumed that small companies are more adaptive to change. This can either be because they have not settled all parts of the company completely, or because they have fewer processes to change than large, established companies. Therefore, their business models are also more likely to be adapted by external factors than the SBMs of larger software organizations, which is assumed to increase the diversity in the empirical results. Secondly, smaller companies are often easier to get in touch with, and more willing to participate in interviews. This increases the likelihood of the desired case company selection to form the basis of the research. In addition, the CEOs of small companies often prioritize such interviews. As management representatives have good insight into all aspects of the company, they are highly desired as interviewees when discussing the case companies' business models. This increases the interviewees relevance in relation to the research. Summarized, targeting small and young companies is assumed to increase the quality of the empirical foundation in this thesis.

4.3.3. Data Collection

The case companies contributing to the study were found through the Norwegian startup accelerator The Factory. In their map of the Norwegian proptech scene in 2019, an overview of Norwegian software companies targeting the real estate industry is displayed. This map is presented in Figure 9. As the figure shows, the map sorts proptech companies in eight categories, of which the companies in the 'Construction' category were evaluated as potential case companies. Out of nine targeted companies, eight companies were willing to participate in the research.

As qualitative research methods tend to be more open ended than quantitative methods, both Yin (2009) and Bryman (2016) emphasize that research questions should be formulated to keep focus and avoid confusion. Therefore, the problem statement and research questions presented in Section 2 were developed. Further, the interview guide used to gather empirical information was developed based on these research questions. This interview guide can be found in Appendix C. According to Yin (2009), the use of such an interview guide or protocol increases research reliability.

All the interviews were performed by one singe researcher over video, following what can be characterized as a semi-structured design. While following the structure of the interview guide, small adaptations and in-depth questions were added during the interviews. This was done to make

Figure 9: The Norwegian proptech scene 2019 (TheFactory, 2019)

room for relevant digressions and discussions. After the interviews were performed, the recordings of the interviews were transcribed.

Table 10 presents an overview of the eight performed interviews, listed by date.

Table 10: Overview of interviews

Company	Name	Title	Location	Date	Duration
Dimension10	Aleksander Langmyhr	CEO	Video	15.04.2020	65 min
24onoff	Sondre Blaasmo	CEO	Video	15.04.2020	63 min
Parallelo	Kitty Colbjørnsen Aarseth	CEO	Video	16.04.2020	60 min
Varig	Renate Straume	CEO	Video	16.04.2020	66 min
Anonymous	*Anonymous*	CEO	Video	17.04.2020	54 min
Catenda	Einar Gudmundsson	COO	Video	19.04.2020	67 min
Checkd	Cathrine Bore	COO	Video	20.04.2020	66 min
Disruptive Technologies	Jørgen Tegdan	VP Finance	Video	05.05.2020	66 min

4.3.4. Data Analysis

According to Yin (2009), how well the researcher generates theory out of the findings can be defined as 'analytic generalization'. To ensure a solid analytic generalization, the need for a *general analytic strategy* when conducting a case study analysis is emphasized. To create this strategy,

several sub-strategies and techniques are presented. Of these, the cross-case synthesis technique is followed in this thesis.

Yin (2009) argues that the cross-case synthesis technique is specifically applicable if the case study consists of more than two cases, which is the situation. This technique treats each individual case study as a separate study, and aggregates the findings. Therefore, a comprehensive analysis framework was developed, where the responses from each of the eight companies were mapped to the 31 questions asked in the interview (see Appendix C for these questions). Further, the various answers to the questions were grouped and compared, to extract findings that may contribute to answering the research question and problem statement. These findings are presented in the analysis in Section 6.

4.4. Quality of Study

Yin (2009) presents four tests that may be considered relevant in judging the quality of research design. These tests are *construct validity*, *internal validity*, *external validity* and *reliability*. Although several researchers highlight the importance of assessing these factors when recognizing and documenting the quality of a research project, some researchers, including Krefting (1991) and Halldorsson & Aastrup (2003), point out the differences between evaluating quantitative versus qualitative studies. They argue that even though validity and reliability may be important focus areas for quality assessment of *quantitative research*, it may not be the most applicable for *qualitative research*. A more appropriate conceptual model to evaluate the quality, or 'trustworthiness', of of this study, can be divided in the four categories credibility, transferability, dependability and confirmability.

This argument is based on a model developed by Lincoln & Guba (1985), which has been used by qualitative researchers for a number of years (Krefting, 1991). As the multiple-case research method represents a qualitative research method, Lincoln & Guba (1985)'s strategical framework will be used in this subsection to evaluate the quality of the study. Krefting (1991) points out that in addition to be important for researchers when designing ways of increasing the rigor of their qualitative studies, this framework of quality analysis is also important for readers, when assessing the value of the findings of qualitative research.

4.4.1. Credibility

Credibility refers to the truth value of the study, which is whether the researcher has established confidence in the truth of the findings and the context of the study (Lincoln & Guba, 1985). In short, Halldorsson & Aastrup (2003) define credibility as to which extent the participants' perceptions

and the researcher's presentation correspond. In qualitative research, findings are usually obtained from the discovery of human experiences, and is therefore subject-oriented. Hence, the researcher's job to ensure credibility, is to represent the information given by informants as correctly as possible.

Krefting (1991) argues that truth value is perhaps the most important criterion for the assessment of qualitative research. She presents a number of methodological strategies that can be applied to ensure strong credibility. Several of these strategies have been applied in this thesis.

Firstly, a 'light version' of the strategy *prolonged engagement* was carried out. This strategy relates to additional time spent with the informants, which allows the researcher to check that the interviewees perspectives are consistent (Krefting, 1991). The reason why it is referred to as a 'light version', is that the prolonged engagement with the interviewees primarily consisted of an e-mail, where the most essential information gathered about the companies were sent for review to each interviewee. This information included the company descriptions, descriptive data used in the tables, as well as an overview of the most essential findings related to each case companies' business models. All interviewees responded to this e-mail. In addition to ensure consistency in the interviewees responses, this prolonged engagement also ensured a correct understanding from the researchers side of the most important aspects used in further analysis, the subsequent e-mail correspondence is argued to be of high importance related to the credibility of the study.

Secondly, the *triangulation* strategy, which according to Yin (2009) is based on the idea of using multiple sources of evidence to verify the research data, has been applied. Although this is a powerful strategy for enhancing research quality in several of the criterion, Krefting (1991) argues that it is particularly important related to credibility. Several types of triangulation strategies exist. In this thesis, *triangulation of data* and *triangulation of data sources* has been applied. To verify objective statements during the interviews, the information given by the various interviewees was compared to the information obtained in the other interviews. As all the information compared was gathered from the *same type* of data source, namely management representatives in small software companies, triangulation of *data* was applied. To further increase the truth value of the objective statements, triangulation of *data sources* was used, as objective statements gathered in the interviews were compared to data from *several types* of data sources. These sources include a range of various web-pages, articles and industry reports. Web-pages further include the companies' own web-pages, news web-pages, proff.no for financial data, SSB.no for statistical data, as well as

additional web-pages for data related to the real estate industry.

Thirdly, credibility in this thesis has been assured within the interviewing process. Through reframing of questions, repetition of questions, or expansion of questions in situations with possibility of misunderstanding, it has been ensured that observations are internally consistent. In other words, it has been ensured that there is a logical rationale about the same topic in the same interview. This follows the *inteview technique* strategy explained by Krefting (1991).

Finally, the strategy of *structural coherence* ensures credibility by enhancing focus on the way that the researcher integrates the masses of loosely connected data (Krefting, 1991). Through a straightforward table of contents, a detailed explanation of the methodology, and an intuitive order of the sections throughout the thesis, it is argued that the reasoning is structured into a logical, holistic picture. Hence, structural coherence is fulfilled, which increases the credibility of the study.

4.4.2. Transferability

Transferability refers to the degree to which the findings can be applied to other contexts and settings (Krefting, 1991). However, in qualitative studies, findings aspire from the point of view of the interviewees, and can therefore be difficult to generalize (Sandelowski, 1986). Lincoln & Guba (1985) argue that transferability in qualitative studies is ensured as long as sufficient descriptive data to allow comparison with similar contexts outside the study situation is presented.

In this thesis, transferability is ensured through a detailed description of the study context throughout the thesis. This includes the described list of case selection criteria, limitations of the study and descriptions of important aspects of the industry context.

In addition, the strategy of exploiting a *nominated sample*, which Krefting (1991) explains as using of a panel of judges to help in the selection of interviewees in a study context, is argued to be applied. As all eight case companies were categorized as software start-ups targeting the construction part of the real estate industry by the start-up accelerator The Factory, The Factory can be seen as such a panel of judges.

4.4.3. Dependability

The third category, or criterion, defined by Lincoln & Guba (1985) to evaluate the trustworthiness of a qualitative research study, is dependability. This criterion refers to whether the findings would be consistent if the research was replicated with the same subjects or in a similar context, perhaps implemented by different researchers (Krefting, 1991).

However, the challenge of subjective and unique results in qualitative studies, applies for dependability as for transferability. These challenges imply that in qualitative studies, it is not always possible to obtain the same results from an identical study. In addition, unstructured and spontaneous strategies are often used, as the key to qualitative work is to learn from the informants rather than control them (Duffy, 1985). Explainable sources of variability in research findings in qualitative studies can follow from the researcher gaining increased insight as the study progresses, the informant's physical condition when being interviewed, or changes in the informant's life situation (Krefting, 1991). Another reason for variation comes from the fact that qualitative research looks at the range of experience rather than the average experience, which makes abnormal situations important to include in the findings. As some degree of variability is expected, dependability in qualitative studies is concerned on how the logic behind the possible variations is explained (Lincoln & Guba, 1985).

In this thesis, there is little doubt that the data collection has been affected by the time and setting in which it was collected, as a consequence of the the corona situation. This situation has forced Norwegian companies to operate under abnormal and extremely unpredictable conditions in the spring of 2020. To ensure dependability in qualitative research, Krefting (1991) proposes the strategy *dense descriptions of research methods*. In the explanation of the methodology in this thesis, exact methods of data gathering and analysis is explained. This includes the interview guide, where all the questions asked in the interviews are presented, making it possible for other researchers to implement the exact same interview on new case companies. In the analysis, the interpretation of the empirical findings is emphasized, before being compared with theory in the discussion, which in turn results in the findings of the thesis. This way, the reader can follow the logic through the whole thesis, which ensures fulfillment of the dependability criterion.

4.4.4. Confirmability

Sandelowski (1986) explains the last of the four criteria, confirmability, as freedom from bias in the research procedures and results. As some variation in procedure may be present in qualitative research, the focus on freedom of bias in the results, or data, is the aspect of importance (Lincoln & Guba, 1985). Halldorsson & Aastrup (2003) support this focus, by explaining confirmability in qualitative research as whether the results of the study could be confirmed or developed by others.

Lincoln & Guba (1985) described the *audit* strategy as the major tech-

nique for establishing confirmability. This strategy involves an external auditor attempting to follow through the progression of events in a project to try to understand how and why decisions were made. The auditor considers the process of research as well as the data, findings, interpretations, and recommendations (Lincoln & Guba, 1985). Throughout the writing of this thesis, the study supervisor has functioned as such an auditor. This has contributed to ensure that findings are solely based on the data itself, and not on the opinions of the author.

In addition, through careful transcriptions of all the eight interviews, the strategy of *reflexive analysis* has been used, to further ensure that the researcher is aware her influence on the data.

Lastly, the triangulation strategy, which ensured the credibility of the research through comparison of multiple data sources, is also an important strategy when ensuring confirmability (Krefting, 1991). As with credibility, both triangulation of data and triangulation of data sources has contributed to exclude bias in the data throughout the study.

4.5. Limitations

Through the evaluation of the quality of the study in terms of credibility, transferability, dependability, and confirmability, which included assessments of the various strategies applied, it is argued that the study is of sufficient trustworthiness. However, there are certain limitations the reader should be aware of when reading the thesis.

All case companies target the RE industry. This thesis seeks to further develop existing theory on software business models, which implies assessment of findings that apply for *all* software companies, independent of the industry the software company is targeting. However, to ensure that the various case companies can be evaluated against one another, all software case-companies interviewed in this study target the RE industry. Therefore, there is a risk that the external factors affecting the SBMs of these software companies, affect the SBMs of software companies targeting other industries differently. Other software companies may also be affected by different external factors than software companies targeting the RE industry.

The case companies are small companies of young age. All case companies represent small companies of relatively young age. As emphasized related to the case selection criteria, these companies were targeted deliberately for several reasons. However, as the business models of small and young companies are assumed to be exposed to more frequent adaptations than business models of more established software firms, all findings from

the case company selection might not apply for larger firms. This may particularly relate to the frequency of SBM adaptations.

Limited number of case companies. Yin (2009) enlightens that *"the conduct of a multiple case study can require extensive resources and time beyond the means of a single student or independent research investigator"*. As this study is performed by a single student, the decision of limiting the number of case companies to eight was made early in the process. Based on the scope of previous master students performing similar case interviews, this was evaluated as a manageable amount. A challenge connected with a relatively small case selection, relates to the assessment of general findings. Even though certain findings apply for all companies included in the study, these findings are not necessarily representative for all companies that fit the case selection criteria. In addition, a goal of the qualitative research is to gain a broad understanding of the various interpretations and use of SBMs. Naturally, this width would be greater if more case companies were included in the research.

5. Case Context and Companies

The eight case-companies interviewed to gather the empirical data for this thesis, are all targeting the real estate industry. This section will give an introduction to this industry, explaining different types of buildings, the real estate value chain, involved actors in this chain and impacting trends. After that, the eight case companies are presented.

5.1. The Real Estate Industry

Real Estate (RE) can be defined as *'Property including land and the buildings on it, as well as the resources of the land above ground, such as flora and fauna, and below ground, such as water and mineral deposits'* (Chen, 2019). RE properties can be divided in four categories: land, residential, commercial[4] and industrial[5] properties (CFI, 2020).

5.1.1. Building Types

A common way to distinguish between the various types of buildings in the RE industry follows three of the property categories. *Residential buildings* include apartments and housing. *Commercial buildings* can be office buildings, shopping malls, warehouses and hotels. *Industrial buildings* can be factories, business parks, mines and farms, and are usually larger in size. Through expansion opportunities in all three categories globally, the industry is projected to grow at 4.2 percent annually between 2018 and 2023 in terms of market value (Wood, 2018).

Figure 10: Building types in the RE industry

[4]Also referred to as *non-residential* (IFC & CPLC, 2018)
[5]Also referred to as *infrastructure* (IFC & CPLC, 2018)

5.1.2. Real Estate Value Chain

Unrelated to type of building, the different phases in the RE value chain can be divided as illustrated in Figure 11 (McKinsey & Company, 2018; IFC & CPLC, 2018; Papadopoulos et al., 2016).

Figure 11: The RE value chain

This chain covers all aspects from choosing and buying the RE property, to building completion and use. The deconstruction process is not included in the RE value chain. This is due to the fact that building deconstruction and demolition is a complex process which takes place decades after the initial completion of the building, with an entirely independent set of firms, suppliers, customers, and linkages. Hence, deconstruction can be seen as having its own value chain (Hosseini et al., 2015).

5.1.3. Involved Actors

The distinctness of the processes in the various phases of the RE value chain, as well as the fixed-term, project-based nature of relationships along the supply chain, results in a highly fragmented industry structure with many involved actors (McKinsey & Company, 2018; IFC & CPLC, 2018). Table 11 displays an overview of the main actors involved in the different phases of the value chain.

The actors involved in the various phases represent a great variety in firm size, financial assets and core activities (BNL, 2017). As they often buy the construction sites, RE investors and RE developers are essential players regarding the choice of what to build on a site. The RE developers control the overall financial limits of a building project, and are therefore included in financial decisions made in all parts phases of the cycle.

Architects may be consulted in the concept and feasibility phase, but they are particularly important in the design & planning phase. In this phase, several iterations with engineers/ consultants and public authorities are needed to ensure all regulations and requirements are fulfilled.

Related to pre-construction & engineering, contractors are involved to coordinate the entire building process, starting with procurement of raw materials and components, and ensuring necessary equipment is in place.

Table 11: RE value chain phases and associated actors

Phase	Main actors
Concept & feasibility	RE investors RE developers
Design & planning	RE developers Architects Engineers/Consultants Public authorities
Pre-construction & engineering	Engineers/Consultants Contractors Materials & equipment suppliers
Construction & commissioning	RE developers Architects Engineers/ Consultants Contractors Sub-contractors Maintenance employees (cleaning personnel, custodians, etc.) RE brokers
Operations & maintenance	RE investors Sub-contractors Maintenance employees (cleaning personnel, custodians, etc.) Tenants

In the construction and commissioning phase, the contractors engage various types of sub-contractors to perform the different tasks in the building project. Architects and engineers/ consultants continue to be involved when changes are required, which commonly happens during building construction. RE agents are involved related to future renting and sales of the building. When the building is finished, the RE investor, who owns the building, manages property rental and maintenance.

A common way to group actors in the real estate industry is the term 'AEC firms'. This is an abbreviation for Architect, Engineering and Construction firms. In this assignment, 'Engineering firms' include both engineers and consultants, and 'Construction firms' can be either contractors or sub-contractors.

5.1.4. Factors Impacting the Real Estate Industry

The RE industry is in rapid development (McKinsey & Company, 2018). 8 out of 10 companies operating in the Norwegian building and construction sectors claim that innovation is important, and 6 out of 10 have a plan or strategy for innovation (Innovasjonsbarometeret, 2020). Technological development, societal trends and environmental focus are three factors that impact the real estate industry significantly today (Skanska, 2019). The

impacts of these factors will further be described.

TECHNOLOGICAL DEVELOPMENT

The need to increase digital competence and use of digital tools in the RE industry is inevitable (BNL, 2017). According to Bygballe et al., the industry is often portrayed as far behind when it comes to digitalization. The authors emphasize two possible reasons for this. Firstly, the RE industry is one of the industries with the lowest levels of R&D investment in the country. Secondly, the executive part of work performed in the industry involves craftsmanship, which cannot be easily digitized.

However, several factors indicate that the RE industry is getting increasingly more digitized. The graph in Figure 12 is developed by Venturescanner (2020), and shows the rapid growth in proptech funding from 2015 through 2019. Globally, as much as 27,2 Billion USD was invested in RE technology funding. The funding growth in recent years reflects the growing size and importance of the sector (Ivens & Barbiroglio, 2018).

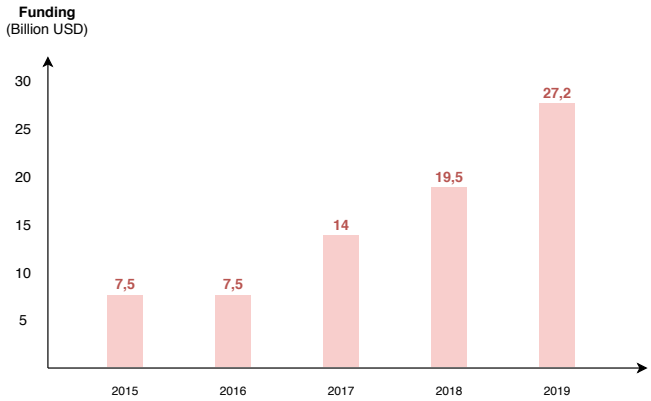


Figure 12: RE technology funding 2015-2019 (Venturescanner, 2020)

Proptech is an abbreviation for 'property technology' (Block & Zach, 2019). The term is a broad concept that encompasses information and platform technology in the real estate sector (Malling & Co, 2019). This includes systems that reduce paperwork, streamline transactions and property management through digital platforms, to 'smart' home technology, metrics for research and analysis, measurement of air quality, CO2, temperature and radon, mobile applications, 3D modeling of properties and mapping of work spaces (Malling & Co, 2019). The term includes construction technology

(ConTech) and commercial real estate technology (CREtech), and overlaps with financial technology (FinTech) (Block & Zach, 2019). In short, proptech solutions can lead to efficiency improvement and simplify activities related to RE, such as buying, selling, renting, people management, appraisers, finance, marketing, development, design, building and investments (Block & Zach, 2019).

The World Economic Forum divides development in RE technology in three eras (Couse, 2018). PropTech 1.0 was primarily about making information about property available online. PropTech 2.0 focused on data analysis and *Virtual Reality* (VR) used for decision support and process improvement. Now, we are in the era referred to as PropTech 3.0. In this era, forward-looking technologies such as drones, VR tools, *Internet of Things* (IoT) devices and blockchain technology is being exploted.

Related to 3D modelling of properties, *Building Information Modelling* (BIM) solutions have grown increasing importance for actors across the RE value chain in recent years (BNL, 2017). BIM is described by Bygballe et al. as one of the most important digital tools (and processes) used in the RE industry today. In their simplest form, BIM models provide information on the physical and functional properties of the structure to be built (Bygballe et al.). In addition to visualization of architecture and graphic representations of the design, BIM can be used for planning, cost estimation, and calculation of life cycle costs and CO2 emissions.

Made possible by proptech solutions, 'smart buildings' is a growing trend in the RE industry. A smart building is characterized by holistic technological solutions that aim to achieve a building that is forward-looking, environmentally sound, and cost-effective in both procurement and operation (Bygballe et al.). Smart buildings offer flexibility, and change with the user. This simplifies juggling between different tenants. In addition, an office building that adapts the usage pattern can allocate workstations, meeting rooms and other in a very efficient way, such that the area needs are reduced. Smart buildings also facilitate more affordable building operation, as the premises themselves know when and where washing is needed and the light and air conditioning automatically turn off when no one is there. This further leads to reduced waste and energy use in the smart buildings.

Expo Real is the worlds biggest trade fair for real estate and investment in Europe. It is also Europe's biggest B2B trade fair in general, and has taken place in Munich every October since 1998 (Hashmi, 2019). At this fair in 2018, the RE innovation ecosystem Builtworld established a 'Tech Alley' in order to promote dialogue between big players and the proptech startups (Naskar, 2019). This indicates that big players from the RE mar-

ket are not shying away from new technologies anymore, but are trying to understand and implement them in their existing businesses and collaborating with startups. This change of mindset is an assuring factor for further development in the RE technology field.

In Norway, leading buyers like Statsbygg and Forsvarsbygg have taken an active role in digitizing and streamlining the industry, by introducing contract requirements claiming that all design should be done in BIM models, and that the construction sites should be paperless (Bygballe et al.). The Federation of Norwegian Construction Industries(BNL)[6] claim that Norway has taken a leading position in international standardization and other international cooperation related to the field, and that this means that we are at the forefront internationally when it comes to digital development in the industry (BNL, 2017). Together with a number of players, the organization has developed what they call the 'Digital Roadmap'. By following this roadmap, BNL aims to reduce costs by 33 percent, lower gas emissions by 50 percent and have 50 percent faster project execution in the building, construction and RE industry by 2025.

Skanska (2019) emphasises that as new technologies and products addressing various parts of the RE chain are being offered, the demand for connectivity between tools as well as actors in an already fragmented industry increases.

SOCIETAL TRENDS

Urbanisation represents a societal trend with large implications for the real estate industry. According to Skanska (2019), 70 percent of the worlds population is expected to live and work in cities by 2050. With urbanisation comes an increased need for efficient and flexible transport and mobility solutions, as well as other infrastructure development related to energy and water systems. A challenge is offering affordable housing alternatives and ensuring a high quality of life for the residents.

Another societal trend impacting the Norwegian RE industry in particular, is the increased willingness to pay for dwellings in Norway. This trend must be seen in relation with the positive economic development in the past couple of years (Skanska, 2019). The development of housing prices in Norway illustrates how a positive economic development has impacted potential financial benefit for the actors involved in the RE value chain the past two decades (SSB, 2019). Figure 13 shows that while inflation (CPI)

[6]BNL is short for 'Byggenæringens Landsforening', which is the Norwegian name of the Federation of Norwegian Construction Industries

has increased by 70 percent since 1992, prices of existing dwellings increased by more than 500 percent.

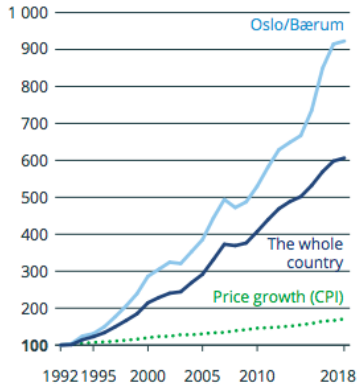


Figure 13: Price development on existing dwellings in Norway 1992-2018 (SSB, 2019)

ENVIRONMENTAL FOCUS

The construction industry represents 40 percent of the worlds carbon emissions (Skanska, 2019; Varig, 2020). According to IFC & CPLC (2018), the momentum toward environmental sustainability is all over the industry. This view is supported by Innovasjonsbarometeret (2020). Based on a survey of 170 companies in Norwegian building- and construction industry, they evaluate environmental sustainability as the factor that will influence innovations the most the next five years (Innovasjonsbarometeret, 2020). Companies included in the construction value chain can apply various methods to embed sustainability into their operations and products. These methods include internal carbon-reduction targets, development of innovative green products, advocacy for sustainability standards, and integration into the circular economy (IFC & CPLC, 2018).

5.2. Case Companies

Below follows a short description of each eight case companies interviewed to gather empirical data for the thesis. The companies are presented in alphabetical order.

24ONOFF

24onoff is a Trondheim-based software company established in 2013. The company offers a cloud-based productivity tool for sub-contractors, operating in the construction phase of the RE value chain. The solution is modular, and includes time registration, project management, scheduling, HSE and deviations. It is accessed through a web interface for project control, as well as a mobile/pad application for on-site use. 24onoff employs seven employees today.

CATENDA

Catenda was established as a spin-off from SINTEF Building and Infrastructure in 2009. SINTEF is one of Europe's largest independent research institutions (SINTEF, 2020). Catenda's core product is Bimsync, which is a cloud based data- and collaboration platform for the construction industry. The users of Bimsync access 2D, 3D and 4D BIM models through mobile/pad and web interfaces, and feed the models with information. In addition to sell to RE actors, Catenda sells Bimsync to other software companies for implementation in other products. Today, the company operates in Europe, North and South America as well as Asia. Catenda has 30 employees, and offices in Oslo and Bergen.

CHECKD

Checkd was founded in 2013, and develops and markets a software solution for communication, collaboration and documentation in construction projects. The solution is used on mobile/pads as well as through a web dashboard, and has a built-in checklist generator. It may also be used for handover and protocol signing and real estate management. Checkd is based in Oslo and employs eleven people.

DIMENSION10

Dimension10 develops collaboration and visualization software for RE developers, architects, engineers/consultants and contractors. The company was established in 2014. Users apply the software through 3D glasses, as well as web interfaces. The company is Oslo-based and will have 15 employees autumn 2020.

DISRUPTIVE TECHNOLOGIES

Disruptive Technologies was established in 2013, and develops tiny wireless sensors that monitor temperature, proximity, humidity, and more. Most of their customers are other software companies building smart solutions on Disruptive Technologies' platform, offering solutions for commercial real estate, connected living, retail, food service and safety. Today, Disruptive Technologies employs 27 full-time employees. The majority of the employees are located in the company's offices in Lysaker and Trondheim in Norway, while some work remotely from England, Germany and the US.

PARALLELO

Parallelo was established as a spin-off from the architecture company TAG Arkitekter in 2019. The company develops software that aims to maximize potential in large urban housing projects, through generation and optimization of room solutions. Today, the company has its office in Oslo with six employees.

VARIG

Varig Technologies was established in 2019, by Renate Straume, who is the CEO of the company today, and Norselab. Norselab is a Norwegian cofounder for 'meaningful technology startups' (Norselab, 2020) [7]. Varig is launching its first product in June 2020. This solution aims to improve the environmental performance of commercial buildings, through gathering building data related to energy consumption and materials and visualizing these data through a web interface. Today, the Oslo-based company has four full-time employees.

ANONYMOUS

This company was established in 2012, and develops robot software that replaces manual "dirty and dangerous" work on the construction site. The company defines themselves more as a robotics company than a proptech company, as the robots and programs they create may also be used in other industries than the RE industry. This company delivers software primarily to one customer, who uses this to produce and sell robots globally. The company has two offices in Norway, and 15 employees.

As it is a subject to confidentiality agreements, this company chose to be anonymous in the study.

[7] Norselab is also cofounder of Disruptive Technologies, and became an investor in 24onoff the spring of 2020

5.2.1. Case Company Overview

An overview of the case companies is presented alphabetically in Table 12 below. This information is gathered from the companies' websites, interviews with company representatives as well as Proff.no (2020).

Table 12: Case companies

Name	**Established**	**Office Location(s)**	**# Full Time Employees**	**Turnover 2018 (MNOK)**	**Core Product(s)**	**Target Customer**
24onoff	2013	Trondheim	7	4,5*	Web-based productivity tool	Sub-contractors
Catenda	2009	Oslo and Bergen	30	12	Cloud based data- and collaboration platform	RE developers Architects Engineers/ Consultants Contractors Sub-contractors Software developers
Checkd	2013	Oslo	11	5	Software tool for communication, collaboration and documentation in construction projects	RE developers Contractors Sub-contractors
Dimension10	2014	Oslo	15	2	VR based software for project collaboration and visualization	RE developers Architects Engineers/ Consultants Contractors
Disruptive Technologies	2013	Lysaker and Trondheim	26	N/A	Tiny wireless sensors	Software developers
Parallelo	2019	Oslo	6	0,5*	Parametersoftware that generates and optimizes apartment solutions in large housing projects	RE developers Architects
Varig	2019	Oslo	4	N/A	Software tool for visualization and optimization of CO2 emissions in commercial buildings	RE investors, RE developers
Anonymous	2012	Two Norwegian cities	15	25	Robot software	Materials & equipment suppliers

Figure 14 shows the distribution of targeted customers. From this figure, it is evident that all the case companies target other companies as customers. In other words, all case companies apply a B2B approach.

Further, the figure shows that two of the case companies target a customer segment that is not a r actor. This segment represents other software developers, offering their own solutions building on the case companies' so-

*Number from 2019

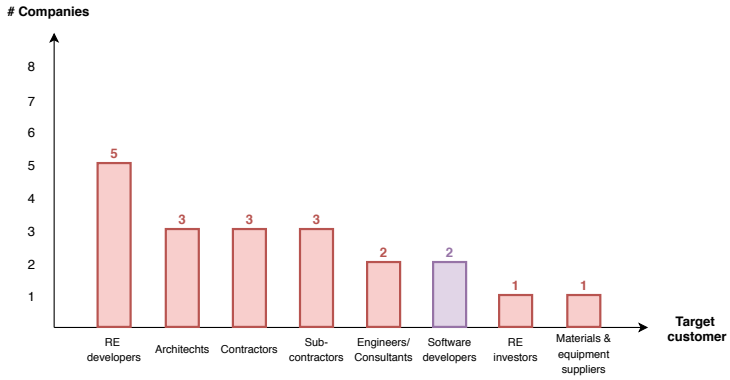


Figure 14: Distribution of targeted customers

lutions. As these software companies further target real estate actors, all case companies target actors in the RE value chain, directly or indirectly.

6. Analysis

This section presents the most prominent findings from the interviews with the software company managers. Firstly, an analysis of how the interviewees interpret the term 'business model', including which components they associate with the term, will be appraised. Secondly, the practical application of these components will be analyzed. Thirdly, an analysis of how the case companies adapt these components to external factors is carried out.

6.1. Concept Perception

When asked how familiar they were with the term *'business model'*, half of the interviewees claimed to know the concept quite well, erupting enthusiastic statements like *"Oh yes, we've talked a lot about that!"*. The remaining half stated that they were partly familiar with the term. Nevertheless, all interviewees are highly involved in development of their respective companies' SBM today.

All the interviewees emphasized the different interpretations and applications of the concept. *"There are large variations in content to add to the term"*, one of the interviewees said affirmatively. Another stated that *"After all, there may not be only one definition of a business model. And the term is used very differently"*.

Several of the interviewees highlight the importance of the SBM. Another said that *"As a matter of fact, it's about the foundation we have that makes us able to do business"*. Related to the SBMs importance, two aspects stand out as particularly prominent. The first relates to company growth and scalability. This was emphasized specifically by three of the interviewees, of which one stated *"the business model is very important, given that we want to scale the company a lot"*. The second aspect concerns communication of the value proposition, both to internal employees as well as external customers and partners. *"It is absolutely crucial that the employees understand what value we offer"*, one of the interviewees stated.

6.1.1. Parallel Models

Two of the case companies currently exploit two parallel SBMs. In these cases, the two parallel SBMs are a consequence of the fact that these two companies either offer, or plan to offer, two very different software solutions, or value propositions. One possibility is for these companies to apply one encompassing SBM, where the VP consists of a product portfolio. However, the company representatives themselves refer to their BMs as two individual BMs, an relates these to the different VPs.

As it reduces the complexity of one encompassing model, it is argued that in cases where two different value propositions imply large variations in the other BM components as well, it can be beneficial for a software company to apply two different business models at the same time. This makes it easier to communicate the logic behind the models both internally, to the employees, and externally, to potential customers and partners.

6.2. Software Business Model Components

Even though all interviewees emphasized the importance of their company's business model as a whole, some components appeared as more important than others during the interviews. These components were revealed when the interviewees were asked to explain their companies' BMs. Then, a large variation in components were included in the explanations. While one interviewee included all six components in the description, another associated the company's SBM exclusively with the company's revenue model. *"If people ask me what type of business model we have, I would say we have a license based business model. We sell licenses"*, this interviewee explained, referring only to the revenue streams component. The remaining six interviewees included various components in their descriptions. Which components they associated with the term is illustrated in Figure 15.

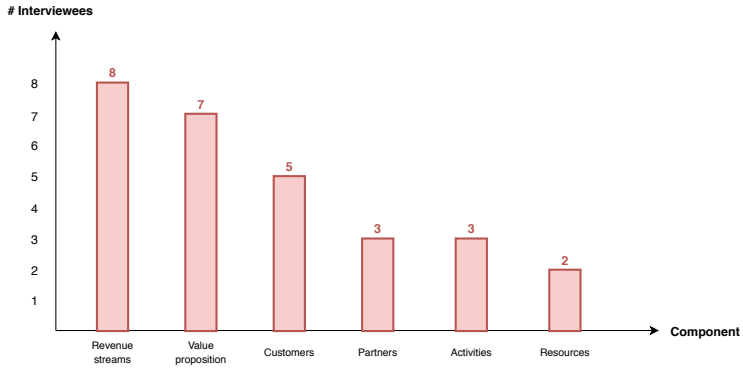


Figure 15: Components included in the interviewees' SBM descriptions

Figure 15 shows that after revenue streams, the value proposition was also highly associated with the SBMs These two were followed by the customers, partners, activities and resources components, in this order. Nevertheless, all six components were included in the descriptions, and further described later in the interviews.

In the following, relevant findings and characteristics associated with each component are presented. To ensure consistency, the components are described in the same order as in the theoretical background, based on their connection to the create, deliver or capture categories. This is illustrated in Figure 16, which also shows the interrelations between the components.

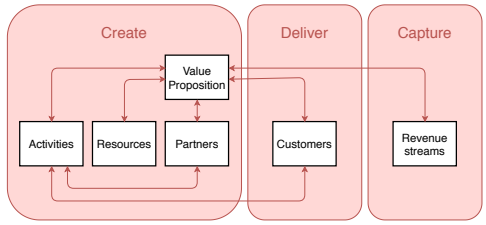


Figure 16: Overview of the SBM components, with interrelations

6.2.1. Value Proposition

SIMILARITIES: CLOUD-BASED OFFERINGS AND STANDARDIZATION

From the interviews, two similarities related to the value proposition emerge. Firstly, all companies either offer a SaaS solution in the cloud, or plan to offer a cloud solution as soon as the required technology is available at an affordable price. The answers given by the interviewees imply that the primary reason for this is that this is a consequence of customer preferences, simply because it is easier to directly access the updated software solutions compared to downloading the new version every time a new update is available. Secondly, the majority of the case companies have a very high degree of product standardization. The empirical findings indicate that the interviewees anticipate that a standardized product will limit the need of activities related to customer support.

DIFFERENCES: DELIVERY THROUGH APP, API OR HW

Three differences in the case companies value propositions appear from the interviews. Firstly, some of the case companies offer pad/mobile applications. For these companies, the success of the offered solution depends on the number of individual app-users in the customer companies. Secondly, some offer access to their Application Programming Interface (API). The case companies' reasons for sharing their APIs, is either to sell it to customers, or to present it for partners in R&D related activities or exploitation of synergies. This indicates that when the case companies share their APIs,

they are certain of capturing some sort of value in return. Thirdly, some require additional hardware purchase. These companies face a challenge, as this requires higher up-front costs for the customers.

MODULAR SOLUTIONS VERSUS PRODUCT PORTFOLIOS

Whether the case companies offer one single product, modular solutions or product portfolios varies among the case companies. Only one of the companies sticks to one single product, without modular functionality. The most applied offering assessed represents modular solutions, which half of the case companies apply. The remaining three companies offer product portfolios.

When purchasing a modular solution, the customer can choose to buy certain parts, or modules, of the product, and potentially increase product functionality for a higher cost gradually, through increased costs per additional module. The companies offering modular solutions often target customers with low liquidity, such as sub-contractors and small architect offices. Hence, it makes sense to offer these companies a value proposition that makes them able to start using the product at low cost.

The companies offering product portfolios offer products that can be used independently of each other. As it takes time to develop unique value propositions, these solutions are offered at a higher price charged than additional modules in modular solutions. Therefore, companies offering product portfolios typically target companies with a high and stable capital level.

6.2.2. Activities

Four types of activities emerge as essential to perform in software companies. These are R&D, customer support, new sales and administration, of which R&D is the clearly most important activity.

In the interviewee's descriptions, R&D includes research, prototyping and user testing, in addition to development of the programming code. Apart from two companies mentioning that they outsource the programming to developers in eastern Europe, the interviewees did not give any detailed descriptions of how the programming activities take place. As the management representatives interviewed are highly involved in BM related work, this indicates that details related to code development specifically, does not affect the business model to a large extent.

What the managers did elaborate on, was the degree of influence individual customers has related to product development. This relates to the 'research' part of R&D. All case companies continuously gather feedback from customers to ensure that they are happy with the product, and take

the feedback into account when developing the value offering. There is little doubt that the customers of the case companies have strong opinions and preferences related to further development of the software solutions they are buying. *"Ideas are everywhere! We get a lot of input from our customers to work with. A significant part of what we do is based on customer feedback and wishes"*, one of the interviewees explains. While the majority looks as the feedback from all customers combined, some of the companies develops the product according to specific customers' preferences. These companies typically represent companies offering value propositions with a high degree of customization.

FROM OUTSIDE IN TO INSIDE OUT DEVELOPMENT

An interesting trend related to research activities, is the movement from an outside-in approach to a more inside-out approach to customer interaction. In an outside-in approach, the software companies take it for granted that their customers' know what kind of solutions they need to reach their goals. Therefore, development of the VP is to a large extent based on customer feedback. However, in an inside-out approach, the software companies does not take this for granted. Instead, they try to understand their customers problems on their way to reach their goals. This way, the software companies work like combinations of consultants and developers, trying to make their customers achieve their goals through appropriate software solutions.

As understanding their customers' problems require industry knowledge, the emerging trend of applying an inside-out approach leads to an increased focus on hiring employees with industry competence as the companies grow. The companies with an inside-out focus are found to exploit strategical partnerships, such as partnerships with other software companies or investors involved in product development.

6.2.3. Resources

As one of the interviewed CEO's formulate it: *"The programmers are our gold"*. There is unison agreement that the internal competence is the most important resource of a software company. In addition to technology competence, which covers programming and software development skills, industry competence appears essential. As a matter of fact, few other resources are recognized from the interviews. Only one of the interviewees mentioned IP.

6.2.4. Partners

In the interviews, the company managers were asked to describe their most important partnerships. From theses answers, four different types of partners are assessed. These are R&D partners, strategic partners, financial partners and marketing partners.

R&D partners. The empirical data highlights R&D partners as the most commonly applied type of partner. The most prevalent R&D partners are the customers, which give valuable feedback on the software solutions. *"All in all, the customers are the most important partners in everything we do"*, one of the interviewed CEO's describes. In addition to customers, R&D partners can be other proptech companies offering solutions to the RE industry, or software companies in general, with which collaboration in research activities can be beneficial for both software companies involved in the partnership. A third type of R&D partners are software companies developing solutions on which the case companies build their own software, such as platforms and storage solutions. Examples of these companies are Amazon Web Services, Google and Apple. Lastly, software companies performing outsourced software development can be viewed as R&D partners.

Strategic partners. Strategic partners are involved in organizational activities and decisions. This facilitates company growth, which all the interviewed case companies strive for. Several types of strategic partners are described by the interviewees. Firstly, they can be investors, which, in several of the case companies, offer part time employees contributing in organizational development. An example of such an investor, who is the co-founder of two of the companies and recent investor in a third, is Norselab. Investors can also influence strategic issues through the Board of Directors (B of D). Secondly, strategic partners can be software developers, with which the case companies exploit synergies to support market growth. *"The aim is to increase customer value through collaboration with other technology players"*, one of the interviewees describes, representing a company with more than 30 R&D partners. In addition, one of the case companies exploits educational institutions as strategic partners. In this case, the case company's software solution is applied by students in these institutions, which contributes to increased product usage and facilitates growth.

Financial partners. Financial partners can be investors, banks or mother companies, contributing with capital. Financial partners are of particular importance for software companies in the early phases of their life. This is because software development is expensive, and it takes time before the solution is ready to be sold to customers. Large customers, contributing with capital through large software purchases, are also described as financial

partners by the interviewees. This implies that a customer can be a partner at the same time.

Marketing partners. Marketing partners are primarily resellers. Resellers can either resell the software solution directly, or develop the solution further. In the latter, the resellers can either be software developers further developing the solution, or product manufacturers incorporating software into physical products. All three case companies using resellers have customers outside of Norway. Related to international growth, one of the interviewees claim that *"If you want to succeed in making money on the software, the thing you need is an international giant who can get this out on the world market. It is no use standing in little Norway, thinking that you will break through. For that, it's too difficult out there - with HW products in particular"*. Marketing partners may also be other companies or individuals promoting the company in the industry. Examples of companies that are promotion marketing partners are mother companies and investors. Examples of individuals can be members of the B of D.

From the description of different partner types, it appears that one partner can fulfill multiple partner type characteristics at the same time. For instance, software companies can either be R&D partners involved in research, or strategic partners with whom the case companies exploit synergies to facilitate growth. Similarly, investors can be strategical partners, financial partners, as well as marketing partners.

6.2.5. Customers

"We are very customer driven", one of the interviewed CEOs states. There is little doubt that all case companies are highly influenced by their customers.

SMALL OR LARGE CUSTOMERS?

In Section 5, along with the descriptions of the case companies, a distribution of their targeted customers was presented in Figure 14. This distribution was based on which type of RE player the customer represented. From this graph, it is evident that RE developers represented the most targeted customer segment, followed by architects, contractors and sub-contractors, of which all three were equally targeted by the case companies. It was also evident that none of the case companies targeted individual customers, as everyone applied a B2B approach.

A more generalized customer categorization, which is argued to be more relevant for software companies targeting other industries than the RE industry, is a categorization in large, medium and small companies. The

'large' companies do not necessarily have many employees or global reach, but they are large in terms of assets and available capital. In other words, large companies are financially strong. In addition to small, medium and large companies, software companies are included as its own category.

In the graph in Figure 17, RE developers, RE investors, large architect companies, Engineers/Consultants and materials equipment suppliers are categorized as large companies. Sub-contractors and small architect companies are considered small or medium companies.

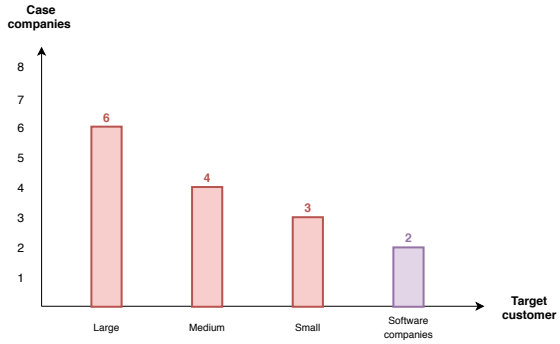


Figure 17: Generalized distribution of targeted customers

One would maybe think that software companies would primarily target large companies, as new software solutions can be costly to implement. These costs can be related both to the purchase itself, as well as potential restructuring and changes in ways of working associated with starting to use a new software solution. However, Figure 17 shows that even though large companies represent the most commonly targeted segment, the eight case companies target a variation in company sizes.

Related to not only targeting large, financially strong customers, one of the interviewees said that *"It can be quite nice to have large customers, but they often seize a large part of the resources, as they are of the opinion that because they pay a lot, they are also allowed to have more requirements"*. These requirements can either relate to customer support or the software solution itself. Related to the solution itself, specific customer preferences may interfere with the companies' value propositions of solutions with a high degree of standardization.

DESIRE FOR GLOBAL CUSTOMERS

More than half of the case companies have global customers today, and

the rest all state that they are aiming for customers outside Norway as they grow. Several of the interviewees highlight that even though the RE industry in Norway is considered conservative, we are ahead of several other countries, which makes Norway a good starting point. *"We have come very far in Norway in terms of digital work. Much longer than many other places"*, one of the interviewees said. Another, representing a company with a mobile application included in the solution, claimed that a challenge in Germany is that many inhabitants do not have smartphones today, which complicates app-usage.

6.2.6. Revenue Streams

The fact that all interviewees included a description of their company's revenue streams when asked to describe their company's BM, indicates that this is the most important component related to SBM application in practice. In addition, it is evident from the interviewees descriptions that revenue streams represents the component with the largest variations in application. These variations are assessed both in the revenue model, which is *how* the case company charges the customer, as well as in the price charged, which is *how much* the case company charges the cusomer.

REVENUE MODEL

Table 13 gives an overview of the various revenue models applied by the case companies. The case companies are represented through numbers in random order.

Table 13: Mapping of applied revenue models

No.	Revenue model	Short description	1	2	3	4	5	6	7	8	SUM
1	One-time Purchase	The customer buys the whole product as it is, and receives unlimited use	x	x				x			**3**
2	License Based	The customer pays for the rights to use the software tool for a specified time interval (at least six months)				x	x	x	x	x	**5**
3	Subscription Based	The customer pays for the rights to use the software tool for a specified time interval (less than six months)		x	x					x	**3**
4	Freemium (Feature based)	The software company offers software with restricted functionality for free			x						**1**

Continued on next page

Table 13 – *Cont.*

No.	Revenue model	Short description	1	2	3	4	5	6	7	8	SUM
5	Freemium (Time based)	The software company offers customers complete software functionality for a limited period of time				x				x	**2**
6	Revenue Sharing	The software company's revenues depend on their customer's benefits associated with the software delivery		x		x					**2**
7	Indirect Revenue	The software company's income does not come from the users of the software product (ex. Commercials)									**0**
8	Loss-leader Pricing	The software is sold for less than its value (ex. Discounts)	x		x	x	x	x		x	**6**
9	Uniform Seeding (Software solutions)	The software company offers the software solution for free to a part of the add ressable market				x				x	**2**
10	Uniform Seeding (Other products/ services)	The software company offers other products/ services for free to a part of the addressable market			x					x	**2**
11	**Multiple Revenue Streams**	A combination of two or more of the above mentioned models	**x**	**x**	**x**	**x**	**x**	**x**		**x**	**7**

Several interesting findings appear from Table 13. These findings relate specifically to the license- and subscription-based, freemium, revenue sharing, indirect revenue and multiple revenue streams models.

License and subscription based models are applied to lock in long-term customers. All case companies except from one, apply either a license based revenue model or a subscription based model with a defined binding or termination time. Applications of long term contracts in these models follow a goal of long-term customer relationships, which all interviewed companies strive for. The fact that there are more license based models than subscription based, supports the desire to lock in their customers. This is because license based agreements comprise a longer time period than subscription based agreements.

Freemium models are applied to gain a large amount of customers. Three companies apply a freemium model. All these companies target small and medium companies, which indicates that they need a large amount of customers to be profitable, compared to companies targeting larger customers. Therefore, an assumption is made that freemium models are applied in practice to attract a large customer base of smaller companies.

Revenue sharing is applied when customers further develop the software solution. Revenue sharing is applied by two of the companies. In both these cases, the customer companies build on the software, either through production of physical products or additional development, before profiting further on the solutions. Based on the customers' further development, their revenues related to the case companies' software solutions vary from customer to customer. To account for these variations, the empirical data highlights the revenue sharing model as an appropriate model.

Indirect revenue model is avoided due to possible association with lower quality products. It is evident from the table that none of the case companies exploit the indirect revenue model. A probable cause to this is that all case companies seem relatively quality oriented. *"We want the price to be at a level which is not perceived as "cheap", because with "cheap" you feel this "Not good"-button: it degrades the quality"*, one of the interviewees explain.

Multiple revenue streams are applied to meet variations in customer base. The bottom line in Table 13 shows that almost all case companies apply a multiple revenue streams model. Two plausible reasons for this may be that they target customers with various capability to pay, or that their customer's potential value gain by using the software vary, and the revenue streams are adapted to this.

PRICE CHARGED

"The only thing impacting the price level is what people are willing to pay", one of the interviewees states. Related to price charged, several of the case companies emphasize a focus on basing the price level on the benefit the customer can receive from using the solution.

Although all companies target RE actors, directly or indirectly, large variations in basis of the price charged appear from the interviews. These variations in basis include number of users, square meters, hours of work, project size in terms of time and number of HW units in use. In addition, they explore new possible bases that are not applied today, such as CO2 equivalents.

Further, significant variations in the amount of the price charged were found. As the case companies offer significantly different software solutions, further analysis of this is evaluated as a complex task that goes beyond the scope pf this thesis.

REQUIRED HW PURCHASE

The majority of the case companies require additional hardware purchase for the customers to be able to use their software solutions. For most

of these, this HW is an app or smartphone. However, three of the case companies require the customers to purchase more expensive additional hardware.

In the first of these companies, the user buys the requested HW from independent producers, which gives the case company no revenue from these sales. In the second, the case company is responsible for the HW production itself, and receives the revenue from these purchases. However, since the required purchase of hardware increases the up-front costs for the customer when initiating their customer relationship, the case company sells these products with limited profits. The interviewee presenting this company also explained that they have tried various models before ending on this one. These rejected models include leasing the HW, and including the HW cost in the license fee so it is paid over several years. In the third company, the customer of the software solution is responsible for the production of the necessary HW itself. In this case, the customer has great influence on further development of the software solution.

As the three companies who require additional HW purchase from their users apply three significantly different methods to ensure this, it is difficult to evaluate which model is the most beneficial. However, it is evident that none of the first two methods leads to significant additional revenues for the company. For the third company, requiring additional hardware for the customers to be able to exploit their software solution limits the case company's independence in further software development. On this basis, it is argued that requiring the customer to buy additional HW to be able to use the company's software, implies an additional challenge for the software companies. This is supported by the CEO of one of these companies stating that *"Our biggest challenge is that you need hardware, new hardware, to use the software"*.

COSTS

The software company's costs are crucial related to the company's profitability. No matter how much money captured through the revenue streams, if the costs are higher than the revenue, the company will not capture value. Still, costs are not included as an individual component in this thesis. The reason for this is the small variations in cost structure between software companies.

For all case companies, the most significant part of the costs goes to labour, of which labour related to R&D activities makes up the largest share. If the company uses an external part to perform the programming services, this service makes up the main cost, which can be seen as the same thing

as labour costs to product development. Apart from labour, rental costs, as well as equipment, including necessary hardware and licenses, are mentioned. The most significant variation in costs between the case companies relates to marketing. However, even in the companies exploiting marketing services the most, these costs constitute to an insignificant proportion of the total.

Although costs are not evaluated as a unique component in this thesis, the cost's relevance to the total value captured is important to keep in mind.

6.3. Software Business Model Adaptation

This subsection will begin by describing the context of SBM adaptation in terms of frequency and involved employees. Further, a comprehensive analysis of how external factors impact each SBM component individually will be carried out.

6.3.1. Adaptation Frequency

One of the interviewees who has been introduced to the BM concept quite recently stated that *"I thought it was going to be completely finished, and then we would just work according to the model, but obviously it's not like that!"*. There is unison agreement among the interviewees that SBMs are never 'finished'.

When asked how frequently the company's BM is changed, one of the interviewees responded *"We have quite a low threshold for tweaking the business model"*, implying that this is happens continuously. Another said that *"I wouldn't say change, I believe 'further developed' is more correct based on what we have done in past."*. When including small adaptations, such as changes in price charged, the empirical data gives clear indications that SBMs are changed continuously.

However, larger adaptations, such as the introduction of a powerful partner, impacting the company with new competence and financial support or introducing the company for a new market where customers might have different expectations, happen more seldom. The interview answers indicate that such changes happen every two-three years in companies that have currently existed maximum eleven years.

6.3.2. Involved Employees

While some of the case companies primarily involve the management group and parts of the sales personnel in decision-making related to the SBM, other companies include all employees in the company.

It can be argued that including all employees in such decisions is easier in small companies, which all of the case companies represent. However,

in relation to work with development of the business model, one of the interviewees states that *"From my experience of working with such things from the past, it is very easy to do individual activities within a group or department or team or however the company is organized, and then feed the results to a management group. So I believe that even if you are big, you should be able to involve the organization"*. This statement indicates that even in larger software organizations, it should be possible to include all employees in SBM adaptation if desired.

All in all, the majority of the case companies try to include perspectives from all their companies' employees in business model adaptation. In addition, the majority of the interviewees emphasize the board of directors' impact on business model evaluations. Still, the management of software companies are the ones making the final decisions related to SBM adaptation.

6.3.3. Adaptations as a Consequence of External Factors

To gather empirical data about SBM adaptation in this study, four external factors were discussed in the interviews. These four factors are technological development, societal trends, increased environmental focus and the corona situation. The reason for choosing these factors, is based on the fact that they are all impacting the real estate industry significantly today (Skanska, 2019; NHO, 2020). These impacts were described in Section 5. As all case companies target the RE industry, directly or indirectly, these factors are assumed to affect all case companies constituting the basis for the empirical data in this thesis.

In the interviews, the interviewees were asked questions related to how development in these factors affected their companies' business models. The answers to these questions confirmed that all four factors impact the case companies' SBMs. Hence, the chosen factors are evaluated to form a solid foundation for further analysis of *how* software business models are adapted as a consequence of external factors, which is the main purpose of this thesis.

In Table 14, an overview of the findings related to how the four factors directly affect each SBM component is presented. The table illustrates that this is found to happen through seven areas of impact. It is emphasized that this mapping only presents the most common effects from the eight case interviews. Therefore, other impacting features, as well as effects on the components, may exist.

Table 14: Adaptations in the case companies' SBM components due to external factors

		Component					
External factor	***Impact***	**Value Proposition**	**Activities**	**Resources**	**Partners**	**Customers**	**Revenue streams**
Technological development	*1. Increased consolidation*	*No direct adaptation*	Increased development efficiency	Increased amount of shared resources	Increased number of R&D and strategic partners	*No direct adaptation*	New revenue models
	2. Faster processing time and improved storage capacity	New functionality, either on the core solution or additional modules Significant change in core solution or development of product portfolios	*No direct adaptation*	*No direct adaptation*	*No direct adaptation*	*No direct adaptation*	*No direct adaptation*
	3. Cheaper hardware	Significant change in core solution or development of product portfolios	*No direct adaptation*	*No direct adaptation*	Increased number of marketing partners	Increased customer base in existing segment Increased customer base in new segments	New revenue models
Societal trends	*4. Increased urbanisation*	New functionality, either on the core solution or additional modules Significant change in core solution or development of product portfolios	*No direct adaptation*	*No direct adaptation*	Increased number of marketing partners	Increased customer base in existing segment	*No direct adaptation*
Environmental focus	*5. Increased environmental regulations and expectations*	New functionality, either on the core solution or additional modules	*No direct adaptation*	*No direct adaptation*	*No direct adaptation*	Increased customer base in existing segment	New revenue models Price charged based on new factors
Corona	*6. Negative economic development*	*No direct adaptation*	Increased development efficiency	*No direct adaptation*	*No direct adaptation*	*No direct adaptation*	New revenue models
	7. Increased digital competence	New functionality, either on the core solution or additional modules Significant change in core solution or development of product portfolios	Reduced customer support	*No direct adaptation*	*No direct adaptation*	Increased customer base in existing segment Increased customer base in new segments	*No direct adaptation*
Number of affecting impacts		**5 (Very high)**	**3 (Medium)**	**1 (Low)**	**3 (Medium)**	**4 (High)**	**4 (High)**

The eight identified areas of impact and following component adaptations will further be described, in relation to each of the four external factors.

TECHNOLOGICAL DEVELOPMENT

"In many ways, technology is the rescue for the construction industry. And it is on its way, whether you want it or not", one of the interviewees said. Technological development represents the external factor impacting the case companies the most. This appears from Table 14, as three areas of impact are identified in relation to technological development, while only one or two impact areas are identified in relation to the other external factors. These three areas of impact are desire for increased consolidation, faster processing time and improved storage capacity, and cheaper hardware.

1. Increased consolidation. Related to technological development, several of the interviewees emphasized a need for a market consolidation among software companies. *"If a consolidation occurs, this will in turn drive the price down for us, which will be an advantage"*, one of the interviewees says.

This illustrates how this would directly affect the revenue streams component. It was also stated that *"Both our supply chain and our competitive landscape are characterized by many small players who work with innovative solutions. And it's a little ineffective when you look at the global, big perspective"*. This statement highlights the need for shared resources, for instance through increased openness of API's, as well as the possibility of establishing R&D and strategic partnerships with actors in the competitive landscape. Also, impact on the activities component was emphasized by one of the interviewees stating that *"Maybe we get a supply chain that is a little more professional, where not everyone is sitting around developing everything on their own, but where you buy ready-made software from each other. And put together"*, which indicates a potential efficiency increase in development activities.

Even though consolidation is encouraged by the majority of the interviewees, and many of them also engage in collaboration activities with other software companies to enhance consolidation, the interviewees describe that due to complex and fragmented market conditions, consolidation will not take place over night. *"It takes time. The reason why we haven't done it so far is that many of the buildings are different, so there is very little structure to the data flow. Digital tools are used to draw and calculate, but there is poor integration between the digital tools we use now."*, one of the interviewed CEOs explain.

2. Faster processing time and improved storage capacity. Several of the interviewees emphasize the positive benefits they may achieve from faster processing time and improved storage capacity. Faster processing time combined with storage capacity and data availability would directly affect the value proposition, through enabling their software solutions to compute faster and more complex computations. Several interviewees highlight the facilitation of digital twin solutions, which may adapt the companies' value propositions. The VPs can be adapted either through development of new functionality on their core solution, or additional modules the customers can choose to add to the core product to increase functionality.

Also, several of the interviewees mention significant changes in the core solution, which may lead to development of product portfolios with additional fundamentally different software solutions. These new products may include smart solutions, which the interviewees believe will experience increased demand. Further, faster processing time and improved storage capacity is a step towards software solution exploiting artificial intelligence and machine learning. However, it was emphasized that it takes time to gather all data needed to exploit the possibilities in AI and ML. Still, several interviewees explain that with time, AI and ML can be used to create even more new service offerings. Combining smart solutions with AI and ML, software related to predictive maintenance of buildings could be developed.

3. Cheaper hardware. The companies requiring purchase of expensive hardware, highlight the possibilities that could follow from a price reduction of these devices. If it becomes more affordable for the customer, the interviewees highlight the opportunity of targeting a larger customer base in their existing customer segment. The interviewees pointed out that cheaper HW cost also enables them to target new customers in new segments.

This could either be a consequence of adapting their software to create new solutions that fits existing HW products, such as application of sensors in new smart solutions for buildings, or applying parts of their software in completely new HW products. An example of the latter is production of robots with new areas of use. To charge for new solutions, new revenue models can be used.

A larger customer base, either in the existing target segment or new segments, may include global customers that are exposed to price reduction of hardware tools. As the case companies are found to often engage in marketing partnerships when approaching customers in new countries, cheaper HW directly affects the partners component.

SOCIETAL TRENDS

The societal trends discussed in the interviews were related to population growth, urbanization and movement patterns, which are factors that especially affect the RE industry.

4. Increased urbanisation. The most evident societal trend affecting the case companies' SBMs is urbanization. As urbanization increases the need for new housing projects in the cities, this affects the work load for all actors in the RE value chain. This implies increased activity in the customer component. This represents an opportunity for software companies targeting this industry to increase their customer base. *"Enormous amounts of building mass will rise in the emerging economies, especially in Asia, but also in Africa south of Sahara"*, one of the interviewees stated. This highlights the global customer focus in the case companies, which may lead to new marketing partners. Also, urbanization leads to increased focus on smart solutions and quality housing in smaller spaces. This involves opportunities in product development and potentially new software solutions.

ENVIRONMENTAL FOCUS

The interviewees expressed an increased attention towards environmental issues among the actors in the RE industry. *"The focus on environmental sustainability is one of the things I'm a little surprised about. I had an assumption that they [RE developers] were less concerned with the environment. After all, they are the source of a huge amount of environmental emissions!"*, one of the interviewees stated, positively surprised.

5. Environmental regulations and expectations. In addition to expectations related to environmental friendly solutions from RE actors with increased environmental focus, increased environmental regulations from the authorities affect several actors in the RE value chain. Examples are the contractors that are responsible for emissions in construction work, and architects and engineers/consultants, involved in work related to the emissions of the buildings. In turn, this impact affects the software companies developing solutions for this industry indirectly. The primary SBM adaptation as a consequence of this impact relates to the value proposition component, as new solutions are developed to meet these requirements. From the interviews, these solutions appear to be primarily related to the core product or modular functionality. When offering software solutions that supports environmental issues, new customers focusing on sustainability in the existing customer segment are anticipated to follow.

In addition, the revenue streams component may be adapted, as increased environmental regulations and expectations may increase customer

willingness to pay for environmental friendly solutions. This gives software companies opportunities to develop new revenue models, as well as changing the basis of the price charged. One of the interviewees mentioned the possibility of the price charged being based on CO2 equivalents, instead of users, square meters or project size. One of the interviewees says that *"I am surprised that the environmental factor is such an active catalyst. That it is something everyone is engaged in. Also in such a way that they are willing to pay for it. It is not just something they say, but something of actual importance. That they want to see it, they want to know it, and they will also tell others why they have chosen it"*. This statement indicates that the external environment today already facilitates new revenue streams, developed based on environmental friendliness.

THE CORONA SITUATION

6. Negative economic development. Although the RE industry is not the industry suffering the most from the corona pandemic, the pandemic has impacted the economy of RE players negatively (NHO, 2020). This directly affects the software companies' customers willingness to pay. Therefore, several of the case companies as adapted their revenue models to include freemium or loss-leader pricing (discounts) in this period. Related to partners, few investors are willing to support small software companies in times with a high degree of financial uncertainty.

However, the empirical data indicates that this neither lead to adaptations of the customers nor the partners components. This is because existing financial partners and customers keep their positions, and it is more challenging to target new or different customers and investors in times with negative economic development. Instead, the negative economy has impacted the activities component, as activities performed with regards to attraction of *new* customers or financial partners has been reduced. When possible, the case companies have allocated redundant employees to focus on new development instead, to exploit the capacity of their workforce.

In addition, several of the case companies has adapted their revenue streams component in order to retain customers with particularly low liquidity during this period. In these cases, the revenue model is adapted through application of freemium models or loss-leader pricing by companies that did not exploit these models before corona.

7. Increased digital competence. The interviewees also emphasize a very positive consequence of the corona situation. As described, they are targeting a traditionally conservative market when it comes to digitalization. *"Many of them [the contractors and sub-contractors] are good at the craft,*

but very poor at everything else", one of the interviewees said, referring specifically to efficiency in tasks not directly related to physical on-site work. Examples of such on-site work include reporting and documentation, which this interviewee claims can be performed considerably faster through digital tools.

As people have not been allowed to meet live, the corona situation has forced people in general to use digital tools more extensively in daily communication. The most obvious example is meetings through video solutions such as Zoom and Teams. *"We see that the usage of our solution has increased for many of our customers in this period"*, stated one of the interviewees, representing a company that offers a software solution that facilitates communication.

Several interviewees appreciate the positive effects that increased digitalization may have on their value propositions, activities and customers components. Related to the value proposition, software companies are now able to develop more complex solutions and advanced functionality, as the interviewees anticipate that their customers will have increased motivation to exploit these tools. This can either be with respect to the core solution, or modular functionality. In addition, several of the interviewees described entirely new use cases where their solutions can be exploited as a consequence of corona, such as optimization of work places.

Related to the activities component, faster perception and understanding of how the software solutions are applied in practice reduces the need for customer support in the initial phase of a customer relationship. Instead, when times will be back to normal, customer support staff can focus on upselling. Related to the customers component, increased digital competence among people in general is found to facilitate both a larger customer base in the existing segment, as well as new customer segments. The reason for this is that an increased share of the potential customers now is able to exploit the benefits of the offered software solutions.

6.3.4. Components Prone to Adaptation

From the descriptions above, it appears that in the case companies, all six components are adapted as a consequence of external factors. The findings related to how each component is directly adapted are visualized in Figure 18.

The bottom line in Table 14 summarizes the number of impacting areas that may cause adaptations in each component. As the value proposition is directly affected by five impacting areas, namely number two, three, four,

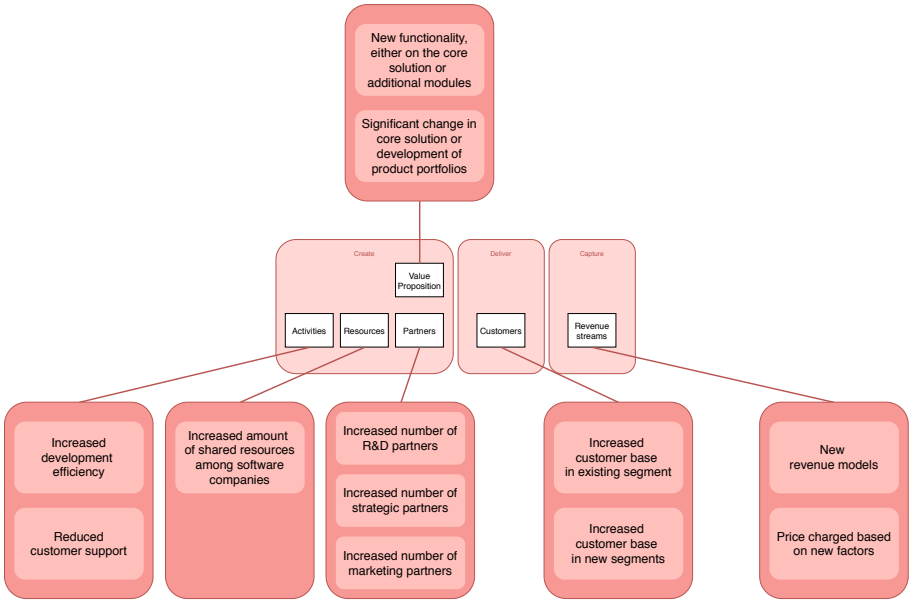


Figure 18: Direct adaptation at component level

five and seven, the VP is prone to adaptation to any of the four external factors. Therefore, the VP is argued to represent the component most prone to adaptation to external factors in a software company's business model.

Customers and revenue streams are each adapted by four impacting areas, and are therefore rated as highly prone to adaptation. Although both activities and partners can be adapted directly by three different impact areas, Figure 18 illustrates that the partners component can be adapted in three different ways, while two different possible adaptations are found for the activities component. Therefore, the partners component is evaluated as more adaptive to external factors than the activities component. The resources component is only adapted by one impact area, and found to be the component least prone to adaptation of the six.

6.3.5. SBMs Modelled for Adaptation

The majority of the case companies are already taking technological development, societal trends and increased environmental focus into account in their SBMs. As these trends materialize, the interviewees anticipate that their business models will work even better than today.

Although artificial intelligence and machine learning are popular buzzwords related to technological development, several of the interviewees

point out that these technologies are still in the exploration phase, and are not used in practice today. However, the interviewees see possibilities related to product development, based on faster and smarter computations, and possibilities related to predictive maintenance. It is emphasized that application of AI and ML will take time, as it takes time to gather relevant use case data, which these technologies depend on. Still, the majority of the case companies already have plans of VP development as soon as application of AI and ML is possible in practice. These plans are already incorporated in their current SBMs.

In addition, several of the case companies already have possibilities related to VP development and customer segment expansion based on the available technology today that they are not exploiting. Related to adaptation of the VP component through development of new software solutions, one of the interviewees said that *"It does not depend on external development, no. I believe the technology is available. For us, it's about building it into our product and our pricing model"*.

From the interviews, it appears that the main reason for limited utilization of existing technology are lack of resources. Resources mentioned particularly are financial resources and industry competence. The fact that the corona situation puts a break on access to new financial resources, contributes to withhold the boost that might have followed from increased use of digital tools in the society in the corona period.

The modelling of SBMs while considering taking exploitation of technological advancement and future environmental focus into account, indicates that software companies in general are forward looking companies. Related to the SBM, this anticipation implies that BMs of software companies are modelled so that they easily can be adapted as opportunities materialize.

7. Discussion

In this section, the findings from the case interviews are combined with theory and the industrial context, in order to assess how software companies adapt their business models to external factors. The discussion follows the two research questions proposed in Section 2.

7.1. Research Question 1: Why are certain components of software business models more prone to adaptation to external factors than others?

From Table 14 and the following empirical analysis, it was found that four SBM components were more prone to adaptation than the remaining two. These four are 1) value proposition, 2) partners, 3) customers and 4) revenue streams. Also, from the interviews, these four components appeared to concern the managers more than the activities and resources components.

Related to number 1), the value proposition component, all case companies were currently developing either their core solution, adding functionality or modules, or developing product portfolios. For 2), the partners component, an expressed desire for increased consolidation had led to recent engagements in R&D partnerships in several of the case companies. As for number 3), the customers component, all interviewees were growth oriented with a global focus. Number 4), the revenue streams, was clearly the component which the interviewees found most difficult to optimize. The majority were adapting and evaluating their revenue model at the time of the interviews.

The theory presented in the theoretical background supports the impression of these four components being particularly prone to adaptation. Related to the value proposition component, continuous software development was emphasized, and different types of software solutions were described. These include modular solutions and product portfolios, SaaP versus SaaS, as well as customized versus standardized solutions. The movement from SaaP to SaaS emphasized by Popp (2011) and Rebsdorf & Hedman (2014), enables companies to offer continuously updated software solutions through the cloud. Sainio & Marjakoski (2009) highlight that customized offerings are particularly resource consuming, which is likely to be a consequence of adaptations to ensure continuous value for the customer.

Theory emphasizes that software companies benefit from various types of partnerships, including resellers, customers and strategical and financial partnerships. Rajala et al. (2003) find an extensive and increasing cooperation between software businesses, which implies rapid adaptations related to both R&D as well as strategic partnerships. As customers often function as R&D partners (Battistella et al., 2019), obtaining new customers

may also lead to adaptation in the partners component. This implies that the partners component not necessarily *needs* to be adapted frequently, but that it may be beneficial, or follows naturally as the companies increase their customer base.

The customers component is adapted through changes in customer relationships, which either follows from new customers, or a change in customer interaction (Melegati et al., 2019). The fact that every customer has it's own preferences, combined with a large variety in both method and frequency of customer interaction, leads to a large span in possible ways to design the customer component. The ability to adapt to customer needs is emphasized by Drew (2015), who further finds that these needs are rapidly changing. As software companies depend on new customers to ensure growth, and the needs of these customers are rapidly changing, there is little doubt that the customers component needs to be prone to adaptation for the company's business model to be useful.

Lastly, related to revenue streams, theory highlighted various volatile factors that influence this components' design. These factors are presented in Table 8 in the theoretical background, and include VP characteristics, customer perceptions of value, network effects and risk level. A large amount of optional component designs appear both through the eleven different revenue models described in Table 7, as well as through the various possibilities in bases of price charged, such as number of users, number of square meters, or project size. Therefore, the revenue streams component seems to be prone to adaptation both because it needs to adapt to volatile factors, in addition to the challenge software companies face when trying to obtain a suitable 'component design'.

The above description of the four components supports the empirical findings of the four components VP, partners, customers and revenue streams as particularly prone to adaptation. Also, three aspects all four components have in common appear. These are 1) a high internal variety, 2) a high degree of customer interaction and 3) they are prone to small adaptations. Therefore, the following discussion investigates whether there is a connection between these aspects and an SBM components' proneness to adaptation.

7.1.1. Internal Variety

Internal variety relates to the number of different ways an SBM component can be 'designed', as well as applied component variations in practice. As a large degree of variety in component design and application provides a wide range of possible adaptations, it is argued that a high variation in

possible designs increases the challenge of finding the optimal component constellation.

In the analysis, *applied* internal variation in each of the six components was assessed. Also, the components' proneness to adaptation as a consequence of the four external factors were rated. These findings are summarized in Table 15 below. The table shows a coherence between a high internal variation and proneness to adaptation for all six SBM components.

Table 15: Empirical findings on essential characteristics of SBM components

Component	**Internal applied variation**	**Proneness to adaptation as a consequence of the four external factors (See Table 14)**
Value proposition	- Runs in the cloud vs runs on customers computer - Customization vs standardization - Pad/mobile app - Open API - HW required - Modular core solution - Product portfolio	Very high
Activities	- R&D - Customer support - New sales - Administration	Medium
Resources	- Competence *1) Technology* *2) Industry* - IP	Low
Partners	- R&D - Strategic - Financial - Marketing	Medium
Customers	- Types of customers *1) Size dependent (based on financial capital)* *- Small* *- Medium* *- Large* *2) Software companies* - Customer interactions	High
Revenue streams	- Eleven different revenue models - Price charged: basis *1) #Users* *2) #Square meters* *3) Project size (time)* *4) #HW units* - Price charged: amount	High

The empirical data presented in Table 15 fits well with the theoretical background for all components, with the exception of the activities component. This component has a large variety in theory, but not in practice. The theoretical assessment elaborated on various development models, including in-house, open source, inner source and crowdsourcing. However, the analysis revealed that details of product development do not concern

the management representatives interviewed. As they are highly involved in BM related work, this indicates that development details are not necessary to include in the companies business models. Because parts of product development may be carried out in collaboration and cooperation with partners and customers, relevant details of development activities are argued to be included in the partners and customers components. The remaining activities are sales, customer support and administration, which all represents a relatively low level of variety.

As the relation between a high degree of internal variety and proneness to adaptation is found both in theory and practice, this thesis argued that an SBM components' degree of internal variety leads to proneness to adaptation.

7.1.2. Customer Interaction

While activities and resources are more related to internal processes and knowledge, value proposition, partners, customers and revenue streams are all found to be highly involved in customer interaction. This is evident from the interrelations illustrated in Figure 7, which was presented in the theoretical background. This figure shows that customer preferences shape VP, that R&D partners can be customers, and that customers' willingness to pay impacts revenue streams. This was confirmed in the interviews. It goes without saying that the customers component itself is highly affected by customer interaction, as this is a part of the component design.

Related to the VP, the case companies' customers are highly involved in further development of the software solutions. This indicates that even though all case companies aim for a high degree of standardization in their software solutions, they all apply user-centric business models. These models are described in theory as users themselves driving value by being involved in the core business processes of new product development, co-creating value with the software companies through interaction (Hienerth et al., 2011).

Theory highlighted several factors that are important for software companies to ensure successful implementation of user-centric business models. These factors include suitable social software design, proper incentive systems, evolutional learning and employee empowerment (Hienerth et al., 2011). All these factors are in place in the case companies. Hence, they all have a good foundation for pursuing user-centric business models.

However, in the analysis, a movement from an outside-in research approach, to a more inside-out directed approach, was discovered. From believing the customers themselves know what they need, which is done in

user-centric business models, the software companies tries to *understand* their customers needs, which may differ from what the customers think. In the inside-out approach, the software companies also take on an advisory role, and proposes software solutions based on their own understanding of how what would create value for their customers. In addition, they try to foresee not only what would create value today, but also what will create value in the future. This trend is supported in practice as several of the case companies show increased interest in hiring new employees with industry competence. In theory, it is supported by the recent studies of Liedtka & Kaplan (2019). They find that understanding the job customers are trying to do, in addition to assess the problems they face while doing this job, enables companies to craft new offerings and shape a value proposition that creates greater value than existing alternatives.

The movement from outside-in to inside-out research leads to a reduction in user-centric business models. However, the value proposition component is still highly dependent on customer interaction, as this is what enables the software companies to understand their customers.

The movement towards inside-out research further illustrates how customer interaction affects the remaining two components found as most prone to adaptation. In the partners component, the customers' role as R&D partners will change. The analysis pointed out that companies with an inside-out focus are found to exploit strategical partnerships, such as partnerships with other software companies or investors involved in product development, which indicates that more of these types of partnerships may be established. Related to revenue streams, the software companies are now able to charge for services offering additional value to the customers, such as advisory services, which impacts their revenue models.

As a result of the assessed coherence between customer impact and the four components most prone to adaptation, this thesis finds that components with a high level of customer interaction are particularly prone to adaptation.

7.1.3. Proneness to Small Adaptations

From the findings in the analysis related to adaptation frequency, it appears that 'small' adaptations happen more or less continuously, while 'large' adaptations happen more seldom. This is due to the size and complexity of large adaptations. An example of a small adaptation is increased modularity in the core solution, while an example of a large adaptation is the introduction of a new strategic partner.

In Figure 19, the case companies' adaptations as a consequence of exter-

nal factors are categorized based on the size of the adaptation. The adaptations categorized as 'small' are evident through light red colored boxes, while the 'large' adaptations are visualized in darker colored boxes. It appears from the figure that the four components prone to adaptation, also are the ones found to be prone to small adaptations.

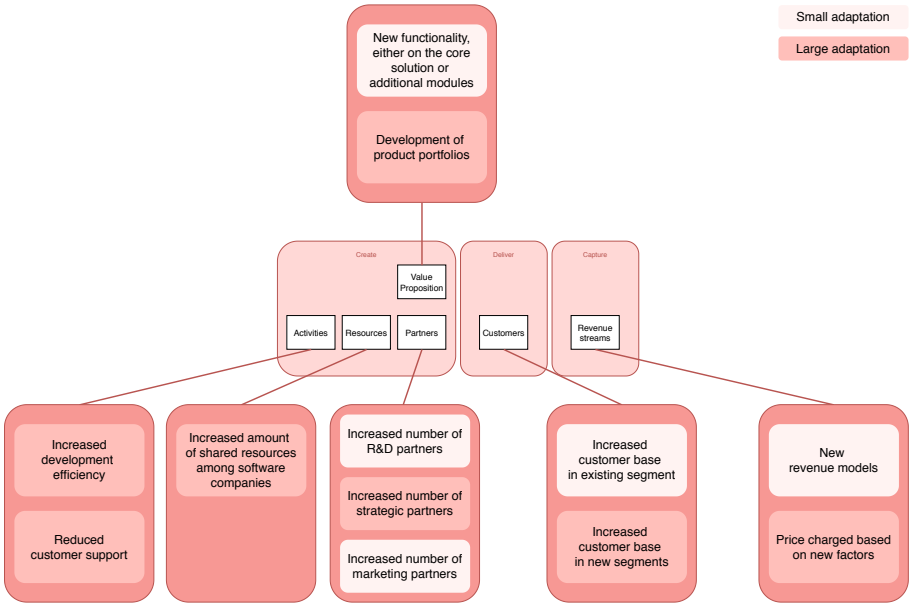


Figure 19: Small and large component adaptations

For the VP component, product development happen continuously in software companies. Therefore, additional features or modules added to the core solution represent small adaptations. A large adaptation requires development of a software solution with distinct differences from the core solution. When a software company creates such additional solutions, they build on their product portfolio, which requires a more demanding process (Rajala et al., 2003; Riemer, 2010). In the analysis, it was emphasized that when a software company offers a product portfolio, several business models can be applied based on the different product offerings. The reasoning behind this was reduced complexity of the business model, which made it easier for employees, customers and other stakeholders to follow the logic of the models. This is supported Lindgren & Rasmussen (2013), who describe that a company can apply several business models in 'BM groups'. Also, it shows that large VP adaptations may lead to new SBMs.

Antero & Bjørn-Andersen (2013) highlight the importance of partners when a software company expands their customer base. Therefore, adaptation in the partners component follows directly from an increased customer base. This can either be because the new customers function as R&D partnerships, or because new resellers, which are marketing partners, are needed. As all case companies focus on growth, both an increased number of customers in the existing segment, and an increased number of R&D and marketing partners, are evaluated as small adaptations.

As most software companies continuously attempt to gain new customers, one may argue that a new customer in the existing segment is a *too* small adaptation to affect a software company's business model. However, the interrelations visualized in Figure 7 show that a new customer may affect several components. In addition to function as a new R&D partner, a new customer may be may lead to new software solutions, as well as impact the revenue model. Therefore, this thesis finds that although small, a new customer may represent an important adaptation in a software company's business model.

Figure 19 shows that adaptations related to the revenue streams component can either concern new revenue models, or new bases of price charged. Of these, adaptations concerning new revenue models may be small adaptations. A new revenue model is obtained when adding or removing one of the eleven described revenue models. For instance, it could be a company adapting from a subscription based model with monthly payments, to a licence based model with yearly payments. Or it could be the introduction or removal of a freemium model. Due to corona, freemium and loss-leader pricing models has been implemented recently in several of the case companies' revenue streams. As these models are easy to add and remove, this is evaluated as small adaptations. However, the interviews also showed that some adaptations of the revenue model are evaluated a long period of time before they are implemented. Table 8 in the theoretical background also illustrates that the choice of revenue models may depend on large adaptations in VP, which takes time. Therefore, it should be noted that even though a new revenue model *can be* a small adaptation, this is not always the case.

The adaptations related to the activities and resources components imply either restructuring of employees, or the actual achievement of increased consolidation, which are time-consuming and comprehensive adaptations.

As small adaptations happen significantly more often than large adaptations, components prone to small adaptations are argued to be particularly prone to adaptation in general.

7.1.4. The Adaptation Model

On the basis of the above discussion, the 'Adaptation Model' is proposed as a tool for managers of software companies in business model adaptation. The reduction of the original business model to the Adaptation Model, is illustrated in Figure 20.

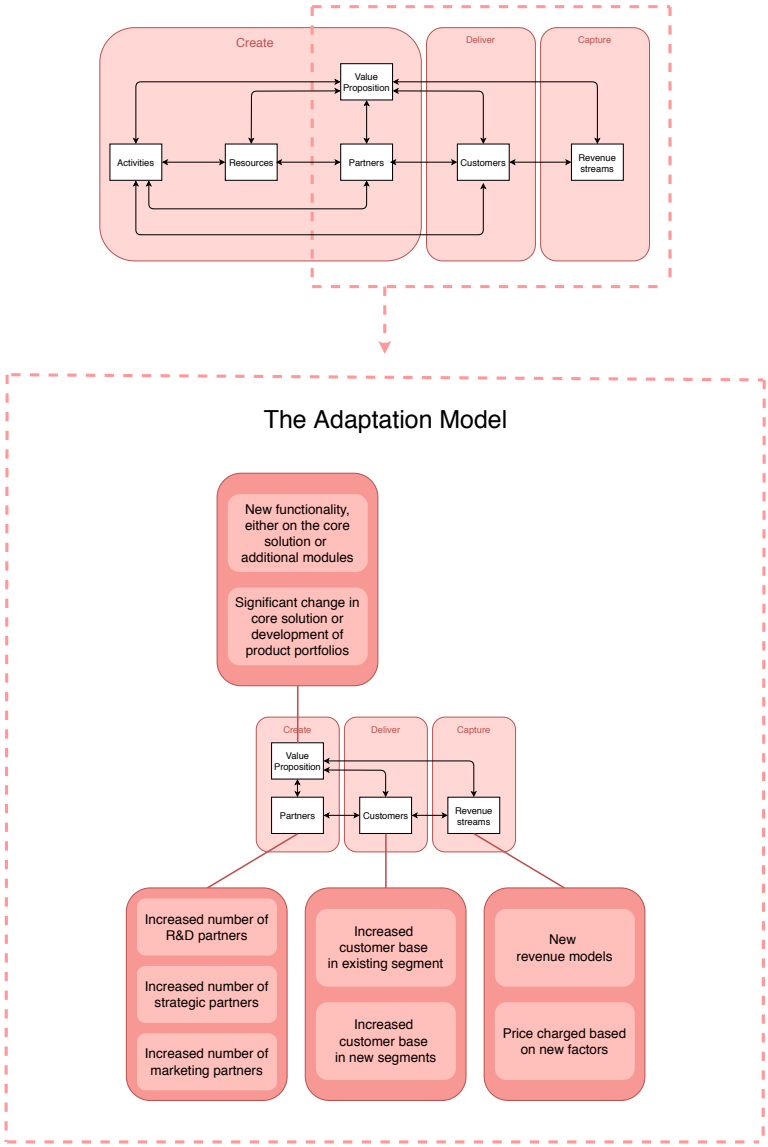


Figure 20: The Adaptation Model

Previous models of business model adaptation, such as 'the Wheel of Business Model Reinvention' developed by Voelpel et al. (2004), often strive to include all aspects of adaptation in one modelling tool. In contrast to these models, the Adaptation Model strictly limits the focus to the components that are most prone to adaptation, which are argued to require the main focus of managers of software companies.

Many models illustrate the impact of specific external factors on specific types of business models. Although this is detailed and valuable for the companies in this context, these tools cannot be used by software companies that are not affected by these exact factors, or do not exploit the exact business models. An example is the '4C Typology' explained by Wirtz et al. (2010), which illustrate the effects of Internet 2.0 on four specific models that are already defined. As the Adaptation Model aims to work as a generalized tool for all software companies, it enables a broader external impact, and does only consist of components that are argued to be included in any software business model.

The Adaptation Model is designed to work as a tool for continuous adaptation, implying that there already exists a business model to adapt. Therefore, it does not take into account the various phases a software company goes through from establishment to commercialization. Compared to the 'Dynamic Business Model Framework' developed by de Reuver et al. (2009), which divides business model adaptation into phases of a software company's life, and points out which factors that are most important in the various phases, the Adaptation Model is intended to be used in the commercial phase.

The majority of the interviewees emphasized that they viewed the software business model as a tool for growth. This is consistent with the theory of Saebi et al. (2017), finding that an orientation towards market development is more conductive to business model adaptation than an orientation towards defending an existing market position. Wirtz et al. (2010) find a growing relevance of user-added value and interaction orientation, which increases the importance of close contact with customers in adaptation processes. As all the components in the Adaptation Model a are highly exposed to customers, it is argued that the model provides a solid foundation for adaptations to ensure growth.

Kaplan (2012) emphasizes that a company's business model needs to be changed if its ability to create, deliver, or capture value declines. This implies that in a tool for SBM adaptation, all three categories should be incorporated. Figure 20 shows how the reduction to the four components most prone to adaptation still includes all three categories defining the pur-

pose of the software business model. Therefore, adaptation related to each category is assured.

Several researchers, including Sainio & Marjakoski (2009) and Popp (2011), emphasize that business models of software companies are subject to *continuous adaptation*. This thesis finds that this 'continuous' adaptation primarily relates to the small adaptations, as these occur frequently in software companies. In contrast, larger adaptations are more comprehensive and occasional. As all the components in the Adaptation Model support small adaptations, the model is argued to ensure continuous adaptation in software companies.

To summarize, the Adaptation Model encompasses all the components in a software business model that are most prone to adaptation, ensures growth due to customer interaction, in addition to ensuring continuous adaptation in all three categories create, deliver and capture. Therefore, the model is argued to be a useful tool for managers of software companies.

Management may use the tool by focusing primarily on the four components value proposition, partners, customers and revenue streams. The described adaptations related to each component can be used as inspiration for specific component adaptation. The differentiation between small and large adaptations is useful when evaluating how to prioritize resources when considering various adaptations against each other. Also, managers may use the detailed descriptions in this thesis, both in the theoretical background and analysis, to increase insight in the various adaptation possibilities related to each component. The majority of the management interviewees said that they attempted to involve all the employees in the company in SBM adaptation. Therefore, management is encouraged to communicate this model to all employees in the company, as this may contribute to a common understanding and directed focus during SBM adaptation.

7.2. Research Question 2: How do the various external factors impact the components that are most prone to adaptation in business models of software companies?

The importance of business models in general to continuously adapt to a *dynamic environment* to stay competitive, is emphasized by several renowned researchers, including Zott & Amit (2010), McGrath (2010) and Wirtz et al. (2010). In this study, the impact of four external factors is investigated to research business model adaptation to a dynamic environment. These factors all affect the RE industry, and were assessed in Section 5. The factors are technological development, societal trends, environmental focus and the corona situation. In the following discussion of the impact of

external factors, they will be grouped into three categories; new technology, customer impact and major changes. This is to enable comparison with existing theory, as well as to generalize the findings to serve as a valuable blueprint for software companies in general. Of the three, *new technology* encompasses the empirical findings related to impact of technological development, *customer impact* encompasses the findings related to societal trends and environmental development, while *major changes* discuss the findings related to the impact of the corona situation.

In the end of the section, characteristics of software companies enabling them to turn the changes in the external environment into business opportunities, are discussed. These characteristics can be exploited in BM adaptation.

7.2.1. Impact of New Technology

From the interviews, new technology clearly appeared as the most important external factor for the BMs of the case companies. Also, theory shows that software companies need to constantly adapt to a technological environment in constant change. Wirtz et al. (2010) emphasize that companies must ensure understanding of *all relevant facets* of this change, in addition to ensure that the *entire firm* is involved in constant environmental scanning, not just the top managers. However, in a world where technology is changing at such a rapid pace, how to ensure a constantly updated view of the technological situation?

Firstly, theory points out close customer interaction. Wirtz et al. (2010) emphasize the customers role as an increasingly important source of information about external changes. The findings of Drew (2015) support this logic, as he emphasizes rapid changes in customer needs as a consequence of the speed in technology development. Secondly, increased consolidation and collaboration among software companies is emphasized in the interviews as a way to ensure an updated view of the technological environment. The reason for this is that increased consolidation leads to access to other companies' technologies. Increased consolidation appeared as a particularly important concern for the interviewees. It was explained that sharing API's and knowledge openly with similar companies, which in many cases also are the case companies' competitors, would make them vulnerable for other companies to take advantage of their findings. However, they were positive that if more companies started doing exactly this, software companies in the sector would benefit from increased knowledge. Still, the case companies seemed to have a high threshold of sharing their knowledge without being certain of getting something in return. Therefore, the majority of the

companies primarily shared their API's and resources with trusted R&D partners and strategic partners. Although this cannot be defined as pure openness, it can be seen as a step towards increased consolidation.

Assuming an understanding of the technological environment is obtained. How is this understanding exploited by software companies to create, deliver and capture value?

To create and deliver customer value, the case companies exploit impact of new technology through their software solutions. In other words: the VP component is adapted due to new knowledge. As a consequence of new, available technology, Willemstein et al. (2007) find an increased diversification in product development. This diversification is further explained as hybridization of software solutions, from either product, service or platform to a *combination* of these. This view is supported by the empirical findings from the interviews, related to development of the core solution to solutions that are significantly different. Willemstein et al. (2007) find that adaptations of the core solution to hybrid solutions, happen during a time span of two to seven years, which supports the categorization of significant change in core solution as a 'large' adaptation in this thesis.

In the interviews, faster processing time and improved storage capacity was mentioned in particular related to new opportunities in VP adaptation, following from new technology. It also appeared that the case companies already accounted for future technologies in their current development, such as improved digital twin technology and artificial intelligence. This foresight ensures that when the new technology will be available, the necessary adaptations in the VP component will not be larger than needed.

To use new technology to capture value for the company itself, the analysis described that new types of software solutions may be charged for through new revenue models. McGrath (2010) also asserts how technology development has enabled several new revenue models for software companies, such as variations of freemium models. This emphasizes that new technology facilitates both small and large adaptations in the revenue streams component.

Bohnsack et al. (2014) emphasize the importance of a supporting technological infrastructure, and find that this affects a company's value proposition, partner network as well as the revenue model. This is supported by the assessment of the impact of cheaper hardware identified in Table 14. As cheaper HW is out of the case companies' control, but impacts the customers' willingness to buy their software solutions, it represents a change in the technological infrastructure. In the analysis, it was described that this may lead to new value propositions (which require significant amounts of

HW), increase the partner network, and enable new revenue streams. These revenue streams may occur as price reduction decreases the total price for the software product with supporting infrastructure as a "package", thus generating additional sales. As additional sales imply an increased customer base, technological infrastructure is found to impact all the components in the Adaptation Model, and facilitate company growth.

7.2.2. Impact of Customer Preferences

Both changes in external societal trends as well as environmental focus impact the case companies *through* their customers' preferences and requirements. For instance, increased urbanisation leads to more buildings being built, which leads to higher activity in the case companies' customer base. Increased environmental focus leads to customers' showing interest in software solutions enabling energy monitoring and control.

This is illustrated in Figure 21. The dotted pink lines show that external factors not always impact the software company directly (through the dark red line), but may be shaped by customer preferences on the way.

Through investigation of various external factors affecting different business models, Wirtz et al. (2010) find a growing relevance of business models that exploit user engagement. These models are referred to as 'user-added value' and 'interaction-oriented' models. In these models, increased digitalization affects the software companies through the customers' preferences related to new product functionality. This illustrates how customer impact may amplify the direct effects other external factors has on the software companies' business models.

In their longitudinal study of software companies targeting various industries, de Reuver et al. (2009) find that regulation only plays a minor role compared to technological and market-related forces in driving business model dynamics. This supports the findings from the interviews, which emphasized the customers' focus on environmental sustainability more than environmental requirements due to state regulations. In their study, de Reuver et al. (2009) were surprised to find such a large impact from market-related forces in all parts of a software business models life cycle. This finding further highlights the customers impacting role in SBM adaptation.

7.2.3. Impact of Major Changes

Previous research emphasize that major changes in the external environment should be met with major changes in the business model as well, in form of business model innovation (Voelpel et al., 2004; Sabatier et al.,

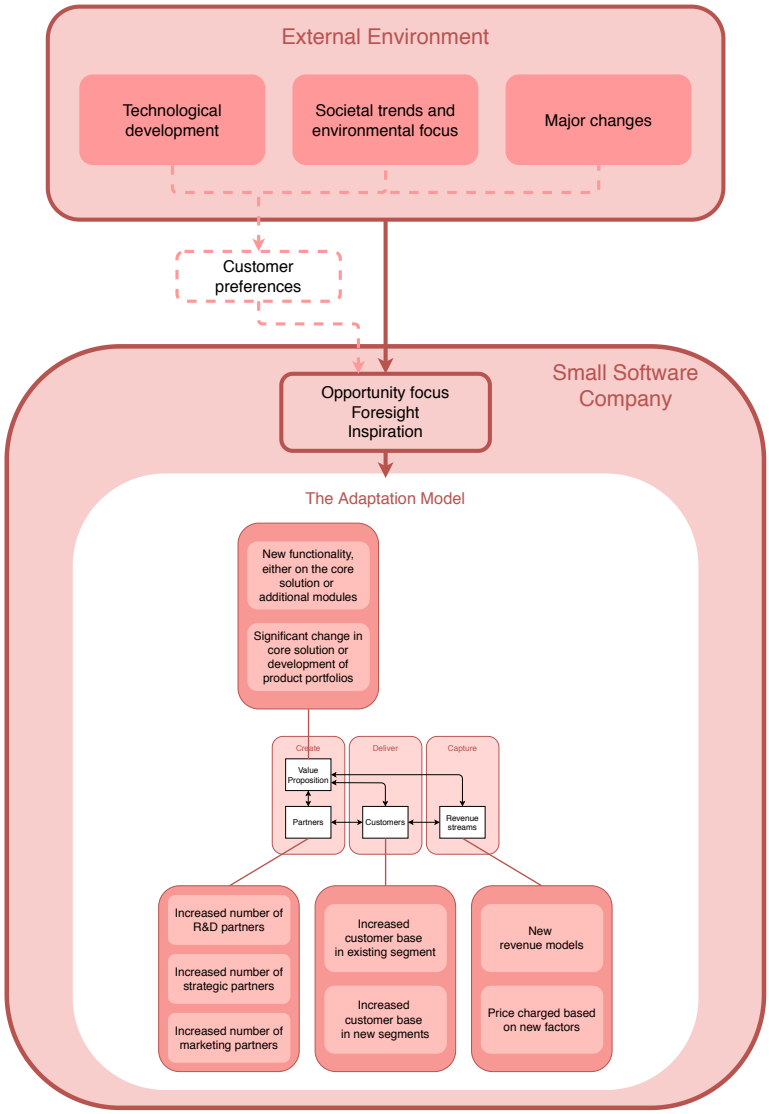


Figure 21: How external factors impact the Adaptation Model

2012). However, the empirical evidence gathered in this thesis indicates the opposite. It should be emphasized that 'major changes' may be challenging to generalize. Also, the empirical evidence on such changes in this study relates to the corona situation only. Nevertheless, as this situation has affected the global society and economy significantly over a time period

of several months, and still is today, it is considered a solid example of a 'major change' (Kampevoll, 2020).

In the interviews, it was emphasized that the corona situation impacted the companies through negative economic development. In addition to impact the software companies through fewer financial investors, this was evident through the customers' payment preferences (visualized in the dotted pink lines in Figure 21). However, the companies did not seem to want to turn their business models up-side down for this reason. Instead, they responded with new time-limited freemium revenue models and reduced price charged, to adapt to customers with lower liquidity. Also, they adapted their activities by reallocating staff from sales to R&D when possible.

A reason for why software companies not necessarily respond to major changes with business model innovation, is that they are agile companies with business models that easily adapt to the external environment. This is supported by the fact that competence is found to be software companies' most important resource (Rebsdorf & Hedman, 2014). In contrast, more mature industries may depend on expensive physical resources that are difficult to adapt, and therefore make companies vulnerable to major changes. The studies of Sabatier et al. (2012) exemplifies this. In their research on how major leaps in technological development has affected the drug industry, they find emergence of disruptive business models, not continuous adaptations. As the drug industry is a more established industry, it needs to respond to new technology by challenging dominant industry logic and reshaping established value chains.

Related to the discussion of major changes as an external factor, the difference between temporary and lasting major changes is pointed out. Although no-one could know for sure, a central aspect of the corona situation was the anticipation of the situation to return to normal. This makes the situation a 'temporary' major change. At the time of writing, the corona situation is still affecting the Norwegian economy significantly (Kampevoll, 2020). However, the society and economy seems to be gradually returning to where we were before the global crisis. When there is a possibility of major changes in the external environment to be temporary, the findings in this thesis indicate that software companies strive to avoid business model innovation, and limit their response to necessary adaptations.

7.2.4. Threats or Opportunities?

External factors are often divided into opportunities and threats in business development analyses. An example is SWAT-analyses. Saebi et al. (2017) find in their studies that companies are more prone to adapt their

business model as a consequence of perceived threats than opportunities. However, the interviews performed in this thesis emphasize that the two concepts can be seen as two sides of the same case. This may be done by twisting the mindset to look at threats and challenges as opportunities instead. For instance, several of the interviewees turned the challenge associated with expensive purchase of required hardware into the opportunity of a potential price reduction of this hardware. The rationale behind this is that with the speed of today's technology development, highly priced hardware has a large potential for future price reduction. Managers in the case companies see this as an opportunity to focus on how to exploit this in further growth.

Even as a consequence of the corona situation, the opportunity-oriented focus was evident through elaborations related to new product development and positive effects from their customers gaining increased digital competence in this period. Hence, this thesis argues for an opportunity-oriented adaptation focus in software companies in general.

7.2.5. Foresight and Inspiration

The empirical study indicates that there is a general forward orientated focus among the case companies characterized by foresight and inspiration combined with continuous adaptation. In general, the companies have an attitude to monitor development trends in the society, identify opportunities and develop their business. This type of business culture is in itself a quality which leads to adaptation of the BM components, and in turn the BMs.

Business model adaptation based on foresight is emphasized in theory as a tool to exploit new external opportunities and markets (Drew, 2015). The analysis explained that the case companies' business models already were 'modelled for adaptation', as the majority of the case companies are already taking technological development, societal trends and increased environmental focus into account when adapting their business models. Based on assumptions on how these external factors will develop, the interviewees anticipate that their SBMs will work even better in the future than today. An example that illustrates this relates to AI and ML technology, which several of the case companies plan to exploit in their solutions as soon as it is beneficial. This shows that SBMs are, indeed, adapted based on foresight in practice.

Theory highlights inspiration through engagement in experimentation, learning and leverage of other companies business models, as an essential factor in SBM adaptation (McGrath, 2010; Popp, 2011). As all the interviewees expressed an interest in the other case companies' models, it is argued

that they exploit comparison with other similar companies when adapting their own models. Hence, inspiration from other companies' models is evaluated as an important tool related to business model adaptation.

Figure 21 summarizes how external factors influence business model adaptation in different ways. The figure shows that these factors may impact the software company's business model either directly, or be shaped by customer preferences. Also, external factors cause the company itself to see opportunities, be foresighted and become inspired, to further exploit these insights in business model adaptation.

8. Concluding Remarks

8.1. Conclusion

This master's thesis aims to gain a deeper understanding of adaptation of software business models by answering the problem statement: *How do software companies adapt to external factors?*

Through a case study of eight software companies, it is evident how various perceptions of the 'business model' concept are applied in practice. A comparison with existing theory on the field is performed, discovering that the software business model can be decomposed to six components, which together fulfills the purpose of business models of creating, delivering and capturing value.

From interviews performed with management representatives in the case companies, the value proposition, partners, customers and revenue streams components emerged as most prone to adaptation to external factors. Therefore, it is argued that increased insight related to these components may improve adaptation of software business models. All these four components were found to have three characteristics common. These are a high degree of internal variety, close customer relations, and proneness to small adaptations. It is found that internal variety leads to challenges in finding the optimal component design, close customer interaction trigger adaptation, and small adaptations happen frequently. Therefore, this thesis argues that the three aspects make SBMs particularly prone to adaptation.

To enable managers to exploit this finding, the 'Adaptation Model' is developed as a tool to be used in adaptation of software business models. The model presents the four components most prone to adaptation, and the interrelations between these components. Also, it presents the most evident component-specific adaptations assessed in this thesis, based on impacts from four external factors. These factors are technological development, societal trends, environmental focus and the corona situation.

Technological development is found to be the external factor with the largest impact on business model adaptation in software companies. The reason for this is that new technology enables new opportunities in software companies' value propositions and revenue models, and ensures a supporting infrastructure. The discussion highlights that customer preferences amplify and shape adaptation effects caused by all external impacts, including technological development. Related to major changes, this thesis finds that although such changes may lead to business model innovation, they cause a significant amount of minor business model adaptations in software companies.

All in all, the thesis concludes that although business models of software companies are created based on foresight, they are continuously adapted as a consequence of impact from external factors. This is ensured through adaptation of the value proposition, partners, customers and revenue streams components.

8.2. Managerial Implications

In addition to contribute to research on SBM adaptation, this study facilitates managers' work related to adaptation of software business models. Through a thorough assessment and clarification of which components a software business model consists of, this thesis claims to contribute to a more straightforward and intuitive understanding of the business model concept. The elaboration on various component designs contribute to give managers of software companies increased insight and inspiration when adapting their own business models. The Adaptation Model is developed to assist managers in any software company in deciding where to allocate resources and focus during adaptation of their company's business models.

Further, the assessment of how external factors affect the model components directly, gives managers an indication of how to adapt their own models as a consequence of trends and development in the surrounding environment. It facilitates an opportunity focus, foresight and inspiration, which enables the companies to adapt their models to factors that are likely to impact the firm in the future.

Lastly, both theory and practice emphasize the value of investigating and comparing models of other software companies when adapting their own models. The interviewees highlight the need for a consolidation between companies in the industry. By emphasizing the lack of consolidation today, despite the benefits such consolidation may give, this study contributes to increased consolidation among software companies.

8.3. Implications for Further Research

To contribute in filling the research gap on business models of software companies, further research is encouraged.

Further research on adaptation to external factors. This thesis investigates *how* an SBM is adapted as a consequence of external impact. Therefore, it represents a responsive study. As the business model is used to ensure company growth, the next step should therefore be a more proactive approach, investigating how a software company *should* adapt its SBM to future external impact. Because of the limited previous research on SBM adaptation, this research area was beyond the scope of this study. Based

on the theoretical contribution provided through this study, this thesis is argued to serve as a foundation for further research on SBM adaptation to external factors.

Research on adaptation to external factors in larger software companies. With less than 50 employees and an annual turnover below 10 million EUR, all the case companies in this study are defined as 'small' companies. The youngest are currently developing their very first business models. Therefore, the adaptations made in the case companies are assumed to occur at a higher pace than adaptations in older and more established software companies. This is supported by the studies of Bohnsack et al. (2014). To complement the research on SBM adaptation to external factors, performing the same case study on more established software companies may give a more nuanced picture of the frequency in which software business models are adapted.

Testing the Adaptation Model. In this thesis, the Adaptation Model is developed as a tool for business managers in any type of software company. As the model is based on empirical findings from interviews with Norwegian software companies targeting the real estate industry, there is a possibility additional adaptations could be favourable to include in a tool for software companies in general. Also, the finding of the VP, partners, customers and revenue streams as the four components most prone to adaptation, could be strengthened by comparison with other software companies. Testing the Adaptation Model on software companies targeting other industries than the real estate industry is therefore encouraged.

Further research on impacts of the corona situation. As this study was executed the spring of 2020, the corona situation represented a possibility of investigating a unique type of external factor. This possibility was exploited in this study. During the time of the interviews, there was a large degree of uncertainty related to how this situation would develop. Therefore, all the case companies' adaptations as a consequence of the global pandemic may not have been made at this point. To strengthen research related to SBM adaptation to *temporary* major changes, investigating the impacts of the corona situation when the situation has stabilized is of interest. This may give new insight in software companies ability to respond to major changes in the external environment compared to other types of companies.

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9. Appendix A: SBM Literary Analysis - Article Information

Table 16 presents information on 19 articles included in a literary analysis on SBMs.

Table 16: Literature review: software business models

Authors	Title	Research method	Research focus	Contributions	Journal	Year
Antero, Michelle C. & Bjørn-Andersen, Niels	Why a Partner Ecosystem Results in Superior Value	Empirical (Qualitative)	Comparison and contrasting of capabilities and resources of two Danish ERP vendors, applying different distribution channels.	The article emphasizes the value of having a partner ecosystem. Reasons for this include partner's knowledge of customers and market in their area, and shared costs and risk of system sales and implementation. The value is proposed further amplified by software products being easy to customize through add-ons. It is argued that technology will increase intermediation and the inclusion of more economic units in the traditional software value chain or value network due to lower transaction costs and increased focus on core competences.	Information Resources Management Journal	2013
Bergvall-Kåreborn, Birgitta & Howcroft, Debra	The Apple business model: Crowdsourcing mobile applications	Empirical (Qualitative)	Investigates Apples' crowdsourcing of mobile applications.	Assesses several factors related to crowdsourcing of software development, both related to the crowdsourcing company (in this case Apple) and the contributors. On the crowdsourcing side factors include increased efficiency and cost reduction. On the contribution side, factors include elusive financial returns and production pressure.	Accounting Forum	2013
Drew, Jeff	Competitive edge: The software vendors' view	Empirical (Qualitative)	Investigates future development of the accounting industry, and the impact software companies will have on this development.	Establishes that the accounting industry faces enormous changes and competition, evident through an increased share of consulting services, value pricing and data based knowledge. Claims that software companies have a high potential of exploiting this development, through development and delivery of services related to automation and data access and analysis.	Journal of Accountancy	2015

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Table 16 – *Continued from previous page*

Authors	Title	Research method	Research focus	Contributions	Journal	Year
Engelhardt, Lutz	Entrepreneurial models and the software sector	Empirical (Quantitative)	Comparing elements of Enterprise Business Modeling (developed in Silicon Valley) with BM elements of emerging and growing software companies in Germany.	Finds that successful German software companies implement traditional business models and specialize in customized IT- and software services. In addition, the authors find that German venture capital in the 1990s for the most part was not able to establish successful entrepreneurial companies like the Silicon Valley model, or create a successful German variant of venture capital involvement in more traditional companies.	Competition and Change	2004
Heaton, Karen Macdonald; Skok, Walter; Kovela, Serhiy	Learning Lessons from Software Implementation Projects: An Exploratory Study	Empirical (Qualitative)	Investigates the room for improvement of organizational learning in software projects.	Concludes that learning outcomes fail to address core issues sufficiently, due to lack of commitment to organisational learning from projects, the difficulty in extracting meaningful lessons from complex projects and focus on sales generation at the expense of improving project outcomes. Makes several recommendations for improvement, including introduction of cross-functional responsibility for project outcomes and targeted competency development for project managers.	Knowledge & Process Management	2016
Hienerth, Christoph; Keinz, Peter; Lettl, Christopher	Exploring the Nature and Implementation Process of User-Centric Business Models	Empirical (Qualitative)	Investigates how companies can successfully implement user-centric business models.	Findings show that implementing user-centric business models successfully requires a comprehensive approach encompassing an appropriate social software design, a transparent intellectual property policy, proper incentive systems, evolutional learning and nurturing as well as employee empowerment.	Long Range Planning	2011
Melegati, Jorge ; Goldman, Alfredo; Kon, Fabio; Wang, Xiaofeng	A model of requirements engineering in software startups	Empirical (Qualitative)	Searches to answer how requirements engineering practices are performed in software startups to create successful products.	Constructs a model that shows that software startups do not follow a single set of practices related to requirements engineering activities, but builds custom processes. These are changed throughout the development of the company, combining different practices according to a set of influences (Founders, Software Development Manager, Developers, Market, Business Model and Startup Ecosystem). Requirements engineering activities in software startups are similar to those in agile teams, although some steps vary due to lack of an accessible customer.	Information and Software Technology	2019

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Table 16 – *Continued from previous page*

Authors	Title	Research method	Research focus	Contributions	Journal	Year
Mets, Tonis; Kaarna, Kalev; Kelli Aleksei	Intellectual Property - Lever or Barrier to the Globalization of knowledge intensive SMEs of Small Country Origin	Empirical (Qualitative)	Investigates *Intellectual Property* (IP) and its strategies in rapidly internationalising companies.	Finds that obtaining IP rights or not obtaining them can either be a barrier to internalization, or block competitors and support knowledge leverage for software development companies. Barriers are connected with patenting being costly in early stages, which leads to copyright and trade secret protection as the preferred protection strategy. Patenting can however be used to block competition and guarantee freedom to operate for themselves, which can increase internal leverage effects. Knowledge leverage can also be obtained through venture capital funding or financial support from academic institutions, which can be easier to obtain with protected IP.	Engineering Economics	2010
Niculescu, Marius F. & Wu, D. J.	Economics of free under perpetual licensing: Implications for the software industry	Conceptual	Evaluates two different business models for software companies that involve a free component, freemium and uniform seeding, and compares these to a model without free offers.	Discovers characteristics indicating optimal choices of business models, based on an analysis of several factors. These factors include word of mouth effects, experience-based learning, constant vs dynamic pricing, initial consumer beliefs of product value, cross-module synergies and number of periods. Findings include that uniform seeding is optimal when customers underestimate the value of functionality and cross-module synergies are weak, and that freemium is optimal when the initial consumer belief of premium functionality is either relatively low or high, but not in between.	Information Systems Research	2014
Ojala, Arto & Tyrvainen, Pasi	Business models and market entry mode choice of small software firms	Empirical (Qualitative)	The relationship between various business models of software firms and entry modes.	The results imply that the product strategy and the service and implementation model of a software firm are closely connected to the choice of entry mode. The distribution model of intangible software products does not seem to have an impact on the operation mode.	Journal of International Entrepreneurship	2006

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Table 16 – *Continued from previous page*

Authors	Title	Research method	Research focus	Contributions	Journal	Year
Popp, Karl Michael	Software Industry Business Models	Empirical (Qualitative)	Investigates business models of successful software companies through an analysis of SAP, Microsoft and Google. Considers potential benefits of moving from development of SaaP to SaaS.	Presents a viewpoint at the structure of business models in the software industry that can be used by software companies to analyze existing and create new business models, to further gain competitive advantage. This model relates company value propositions to the actors involved in the different activities related to software development and delivery.	IEEE Software	2011
Rajala, Risto; Rossi, Matti; Tuunainen, Virpi Kristiina	A Framework for Analyzing Software Business Models	Empirical (Qualitative)	Exploring the concept of business models and its essential elements in software business.	Attempts to create a holistic view of business options based on schemes of things that managers of five case companies found essential when describing their businesses. Develops a framework describing the generic elements of business models in the software industry, divided in the four categories product strategy, revenue logic, distribution model and services and implementation model.	European Conference Information Systems (ECIS)	2003
Rajkumar, T.M. & Mani, R.V.S.	Offshore Software Development: The View from Indian Suppliers	Empirical (Qualitative)	Approaches information systems outsourcing and offshore development of software from the perspective of an offshore software supplier.	Identifies key success factors in offshore development, related to management, staff, project and customers. Evaluates various business models in use, and identifies four stages of growth of relationships between suppliers and customers.	Information Systems Management	2001
Rebsdorf, Mads & Hedman, Jonas	Cloud Challenges for an ERP Vendor: Business Model Implications	Empirical (Qualitative)	Business model challenges when moving towards the cloud.	Presents a case study of Visma, a leading Nordic ERP vendor. Focuses on challenges when starting to compete strategically with SaaS offerings. Finds that triggers for SaaS are a combination of market expectations and technological opportunity, and that the SaaS BM is substantially different from the on-premise model. Examples include changes in licensing model from perpetual licensing to subscription and usage-based fees, which leads to longer customer relationships. Concludes by presenting a phased business model to guide the vendor for a successful transition to SaaS.	Lecture Notes in Business Information Processing	2014

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Table 16 – *Continued from previous page*

Authors	Title	Research method	Research focus	Contributions	Journal	Year
Riemer, Kai	Strategic Positioning in Converging Technology Markets - The Clyp Case	Empirical (Qualitative)	Case study of a German internet telephony software company in an increasingly competitive and converging market (2008).	Facilitates learning on strategic positioning and business model analysis in the faces of converging technology markets, related to the characteristics of a software company.	Communications of the Association for Information Systems	2010
Sainio, Liisa-Maija & Marjakoski, Emma	The logic of revenue logic? Strategic and operational levels of pricing in the context of software business	Empirical (Qualitative)	Examines the relationship between revenue logic, revenue modelling and business models in the software industry.	The authors establishes a clear distinction between revenue at a strategic level (revenue logic) and at an operational level (revenue modelling). An overview of relevant elements related to the two levels, depending on the degree of customization of the software company's value proposal, is presented. Results indicate that strategic and operational levels of pricing are strongly intertwined, and that external environmental factors influence the operative pricing strategy.	Technovation	2009
Wasserman, Anthony I.	How the Internet Transformed the Software Industry	Conceptual	Investigates the impact of the internet on the software industry since the 1960's.	Shows that the huge impact the internet has had on the software industry, has led to software companies modifying their software products, their development methods, and their practices for sales, marketing, and support. The article anticipates that ongoing advances in mobile and cloud computing, styles of user interaction, and software business models will continue to have a large effect on the software industry going forward, leading to innovative new products from both new and established companies.	Journal of Internet Services and Applications	2011
Wesselius, Jacco	The bazaar inside the Cathedral: Business models for internal markets	Empirical (Qualitative)	Evaluates Philips Healthcare's implementation of an *Inner Source Software* (ISS) community platform.	Based on Philip Healthcare's development, the author emphasizes potential benefits of the ISS model, in addition to address necessary requirements. It is argued that successful implementation of ISS can lead to increased software development efficiency in large corporations, partly through reuse of internal software assets.	IEEE Software	2008

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Table 16 – *Continued from previous page*

Authors	Title	Research method	Research focus	Contributions	Journal	Year
Wiederhold, Gio; Gupta, Amar; Neuhold, Erich	Offshoring and Transfer of Intellectual Property	Conceptual	Presents issues related to companies losing value through transferring IP, particularly software, when outsourcing responsibilities.	The paper emphasizes the need for software valuation when developers of software and the users of that software reside in different countries. Analyzes a mechanism for IP transfer to increase control of transferred value through outsourcing.	Information Resources Management Journal	2010

10. Appendix B: SBM Literary Analysis - Component Mapping

Table 17: Mapping of BM components covered in 19 articles on SBMs

Authors	**Create**		**Deliver**					**Capture**	
	Key activities	Cost structure	Value proposition	Customer segment	Customer Relationships	Revenue streams	Distribution Channels	Key resources	Key partners
Antero, Michelle C. & Bjørn-Andersen		x	x		x	x	x	x	x
Bergvall-Kåreborn, Birgitta & Howcroft, Debra	x	x							
Drew, Jeff			x	x				x	
Engelhardt, Lutz	x	x	x						x
Heaton, Karen Macdonald; Skok, Walter; Kovela, Serhiy	x							x	
Hienerth, Christoph; Keinz, Peter; Lettl, Christopher	x		x		x			x	
Melegati, Jorge ; Goldman, Alfredo; Kon, Fabio; Wang, Xiaofeng	x		x	x	x			x	
Mets, Tonis; Kaarna, Kalev; Kelli Aleksei		x						x	x
Niculescu, Marius F. & Wu, D. J.					x	x			
Ojala, Arto & Tyrvainen, Pasi			x	x	x	x	x		
Popp, Karl Michael	x		x				x		x
Rajala, Risto; Rossi, Matti; Tuunainen, Virpi Kristiina			x		x	x	x		x
Rajkumar, T.M. & Mani, R.V.S.	x	x							x

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Table 17 – *Cont.*

Authors	**Create**		**Deliver**					**Capture**	
	Key activities	Cost structure	Value proposition	Customer segment	Customer Relationships	Revenue streams	Distribution Channels	Key resources	Key partners
Rebsdorf, Mads & Hedman, Jonas	x	x	x	x	x	x	x	x	x
Riemer, Kai	x		x		x	x		x	
Sainio, Liisa-Maija & Marjakoski, Emma			x			x	x		
Wasserman, Anthony I.	x	x	x		x	x	x		
Wesselius, Jacco	x								
Wiederhold, Gio; Gupta, Amar; Neuhold, Erich	x								
SUM	**12 articles**	**7 articles**	**12 articles**	**4 articles**	**9 articles**	**8 articles**	**7 articles**	**8 articles**	**7 articles**
% Coverage	**60%**	**35%**	**60%**	**20%**	**45%**	**40%**	**35%**	**40%**	**35%**

11. Appendix C: Interview Guide

All interviews are performed by a single interviewer. The interviewer is responsible for asking the questions, taking notes, as well as audio and video recording.

11.1. Before and After the Interview

In advance, all interviewees have received the interview questions via e-mail to be able to prepare for the interview. Preparation is not required, but can be done if desired.

Before the interview starts, the interviewer clarifies the recording with the interviewee, and the structure of the interview is presented. The interviewee is also asked if he/she/the company prefers to be anonymous in the study.

After the interview, the interviewee is asked if he/she is available for follow-up questions or validation of citations, should it prove desirable in hindsight.

11.2. The Interview

Table 18 presents the interview structure, including all the questions asked. The interviews are divided into four parts: the interviewer, the interviewee, the SBM and external factors.

Table 18: Interview structure

Part No.	Topic	Information/ Questions
PART 1	**The Interviewer**	**Personal background** - Education - Experience **Research purpose of master thesis** - Deeper insight in Software Business Models (SBMs) - Through interviews with small software companies targeting the real estate industry - Problem statement: *How do SBMs adapt to external factors and opportunities?*
PART 2	**The Interviewee**	**Personal background** - Education - Experience - Role in the company **Company information** 1) What is the company's core product offering?
PART 3	**The SBM**	**Use of the SBM** 2) How familiar are you with the term 'Business Model'? 3) Can you describe your company's business model? 4) How important is the business model for the company? 5) How often is the company's business model changed? 6) Which employees are involved in decisions related to the company's business model? 7) In what way(s) does your company strategy differ from the company's business model?

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Part No.	Topic	Information/ Questions
		Questions related to SBM components 8) What are the most important activities performed in the company? 9) Who performs these activities? 10) How are the activities performed? 11) Can you describe the company's cost structure? 12) On a scale 1-10, what is the degree of customization your core product offers? 13) Which customer segments do you target? 14) Who are your most important customers? 15) How do you interact with your customers? (Eg. close vs distant, short-term vs long-term) 16) How is your software solution delivered to your customers? 17) What is the company's revenue model? 18) Who are your most important partners? 19) Why are these partners specifically important? 20) How are the activities performed? 21) How do you collaborate with your partners? 22) What are the company's most important resources?
PART 4	**External Factors**	**Technological development** 23) Which parts of technological development affect the company the most? (E.g. AI (including robotics, sensors, ML, analytics), digital twins, data availability, faster processing time, larger storage capacity, scalable storage capacity) 24) How does this affect the company's business model? **Societal trends** 25) Which social trends affect the company the most? (E.g. urbanization, population growth, infrastructure development, society behaviour, society expectations) 26) How does this affect the company's business model? **Environmental focus** 27) How does external environmental focus affect the company? (E.g. regulations, customer preferences, customer expectations) 28) How does this affect the company's business model? **The corona situation** 29) How is the corona situation currently affecting your company's business model? **Future development of the SBM** 30) Based on the external trends discussed, can you point out 2-3 trends you believe will impact the company particularly going forward? 31) How will these trends affect the company's business model?

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Software Business Models: Adaptation to External Factors

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