Promoting sustainable market development

– A case study of wooden multi-story buildings

Att främja en hållbar marknadsutveckling – En fallstudie om flervåningsbyggande i trä

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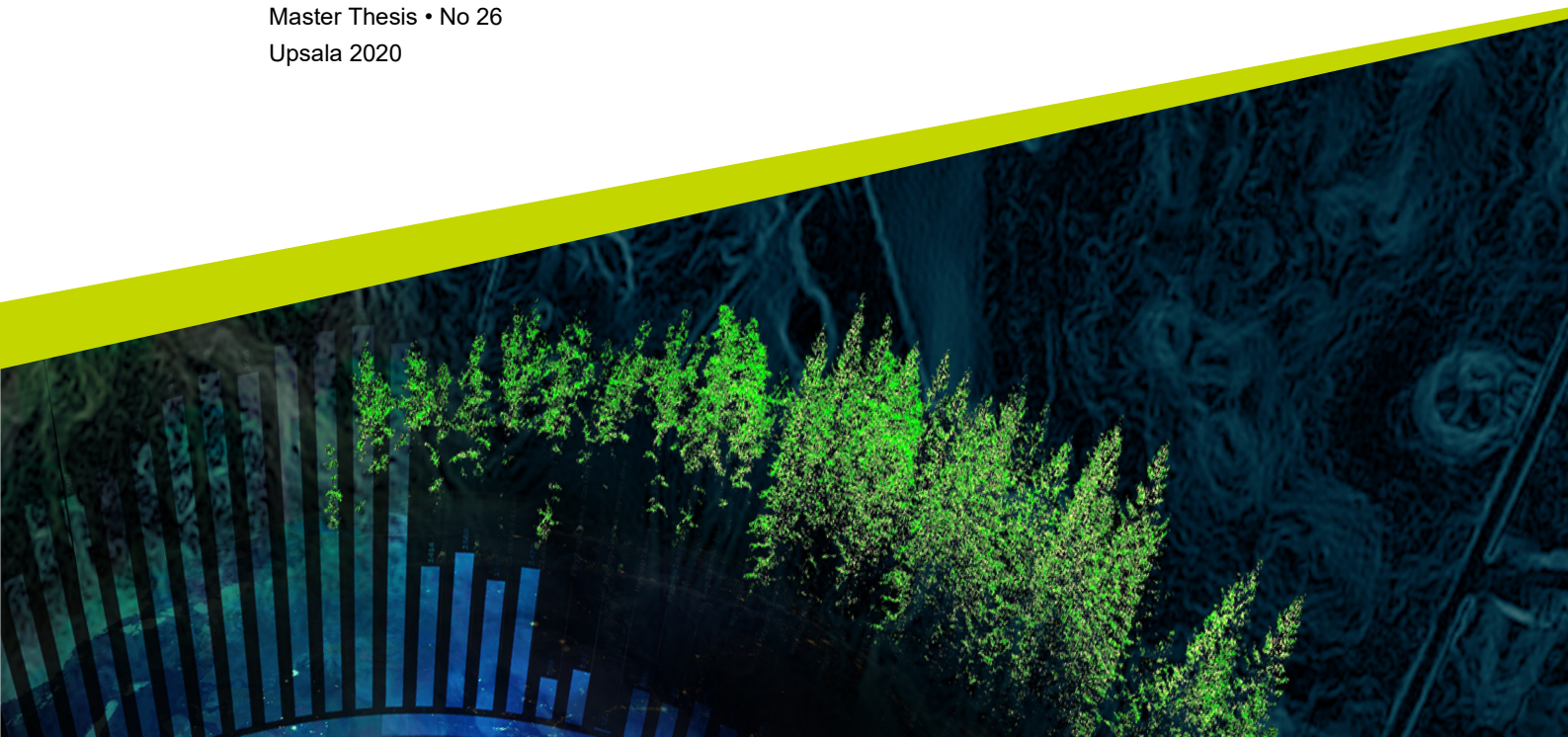
Degree project/Independent project • 30 hp
Swedish University of Agricultural Sciences, SLU
Faculty of Forest Sciences
Department of Forest Economics
Master Thesis • No 26
Upsala 2020



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Credits:	30 hp
Level:	A2E
Course title:	Master thesis in Business Administration
Course code:	EX0925
Programme/education:	Forest Science
Course coordinating dept:	Department of Forest Economics

Place of publication:	Uppsala
Year of publication:	2020
Title of series:	Master Thesis
Part number:	26

Keywords/Nyckelord:	innovation, market development, regional innovation systems (RIS), small and medium-sized enterprises (SME), sustainable development, wooden multi-story construction (WMC) flervåningshusbyggande i trä, hållbar utveckling, marknads-utveckling, regionala innovationssystem, små- och medelstora företag

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Summary

Our planet and societies are about to radically change in becoming increasingly dynamic and complex. Particular drivers for change can be identified as massive environmental and social challenges, such as climate changes, poverty and financial crises. Consequently, this have led to loss of natural resources, violated human rights, and reduced trust, which has enforced an urgent demand for a more extensive corporate responsibility. The construction industry is not an exception when it comes to industries that are expected to proactively contribute to the accomplishment of the global sustainability goals due to its major environmental impact. Despite a long domestic tradition of wooden build single-family houses and a very promising domestic access to relevant natural resources, the current use of wood as construction material for wooden multi-story constructions [**WMC**] can be perceived as inert, compared with other construction materials as concrete and steel.

This project presents a comparative case study of WMC in Sweden. The aim of the research focused on investigating the potential for market development of five Swedish small and medium-sized enterprises [**SME**s] within industrial wooden construction. The methodological approach of this project had a qualitative flexible research design. Data was collected through semi-structured interviews via telephone and Zoom meetings. A discourse analysis was carried out to identify potential themes in the empirical data, supported by an own-developed theoretical conceptual framework. The framework consists of theories such as Regional innovation systems [**RIS**s], Quintuple helix innovation systems, and Ansoff's matrix.

The result of the project shows strategies for market transition, partnerships, research and development, market competitiveness, future goals and sustainable development of the case-companies. Some of the investigated SMEs rely on the current markets by optimising the routines, production, business as usual, and closer relationships to partners, while others of them seek expansion to new markets. Attached to each of the strategies, promotion of environmentally and socially sustainable value can be created in different ways due to the industrial processes and development of societies. The main findings of the project are that SMEs in industrial WMC create competitive strategies in various ways to promote market development and sustainable development of the industry. To access necessary R&D-competence, some SMEs have connected themselves to both regional and external universities and high research institutes [**HEI**s]. Those companies who have not, intends to make such connections in the future. Until then, internal R&D is the main activity to access to relevant knowledge. Compared to large companies, SMEs can also possess unique opportunities that could generate competitiveness and increased market growth via flexibility and quickness. Awareness also of competitive weaknesses, such as economic boundaries and uncertainty, make it possible to manage these via relational proximity in regional clustering together with other companies and knowledge providers.

This project provides a contribution to innovation studies as well as an increased attention towards the importance and eventual competitive potential within SMEs. Through this research, links that goes beyond disciplinary boundaries to regional science studies, market studies, and sustainable research, was created.

Keywords: *innovation, market development, regional innovation systems (RIS), small and medium-sized enterprises (SME), sustainable development, wooden multi-story construction (WMC)*

Sammanfattning

Vår planet och våra samhällen håller på att förändras radikalt till att bli alltmer dynamisk och komplex. Särskilda drivkrafter till denna förändring kan vara omfattande miljöförändringar och sociala utmaningar som klimatförändringar, fattigdom och finanskriser. Detta har resulterat i sinande naturresurser, kränkningar av mänskliga rättigheter och ett minskat förtroende, vilket därmed har förstärkt det brådskande kravet av ett utökat företagsansvar. Byggindustrin är inget undantag när det kommer till branscher som, på grund av sin enorma miljöpåverkan, proaktivt förväntas bidra till att de globala hållbarhetsmålen uppfylls. Trots en lång inhemsk tradition av att bygga enfamiljshus av trä och en mycket lovande tillgång till relevanta naturresurser, kan den nuvarande användningen av trä för flervåningshus [**WMC**] betraktas som trög i jämförelse med andra byggnadsmaterial som betong och stål.

Det här projektet utgör en komparativ fallstudie av WMC i Sverige. Forskningens mål fokuserar på att undersöka möjligheterna för marknadsutveckling beträffande fem små- och medelstora svenska företag [**SME**s] inom industriellt trä-byggande. Projektet utgörs av en kvalitativ metod med en flexibel forskningsdesign. Datainsamlingen utfördes genom semi-strukturerade intervjuer över Zoom och telefon. En diskursanalys genomfördes för att identifiera möjliga teman från den empiriska data och understöddes av ett egenutvecklat teoretiskt ramverk. Ramverket utgörs av teorier som *Regional innovation systems* [**RIS**s], *Quintuple helix innovation systems* och Ansoff's matris.

Projektets resultat beskriver fallföretagens strategier för marknadsövergångar, partnerskap, forskning och utveckling, konkurrenskraft, framtida mål och hållbar utveckling. Några av de undersökta SME förlitar sig på den nuvarande marknaden genom att förbättra rutiner och produktion, ägna sig åt *business as usual*, och närmare relationer med partners, medan andra söker att expandera till nya marknader. I varje strategi kan främjande av miljömässigt och socialt värde skapas på olika sätt genom de industriella processerna och utvecklandet av samhällen. Projektets huvudsakliga resultat uppvisar att SME inom industriell WMC skapar konkurrenskraftiga strategier på olika sätt för att främja marknadsutveckling och hållbar utveckling inom industrin. För att få tillgång till nödvändig FoU-kompetens har vissa SME börjat samarbeta med både regionala och nationella universitet och högre forskningsinstitut [**HEI**s]. De företag som inte har skapat dessa förbindelser avser att påbörja sådana samarbeten i framtiden. Fram till dess är intern FoU huvudaktiviteten för att få att erhålla kunskap. Jämfört med större företag kan SME också besitta unika möjligheter, så som flexibilitet och snabbhet, för att skapa konkurrenskraft och utöka marknadsandelarna. Medvetenhet om konkurrensmässiga svagheter som ekonomiska begränsningar och osäkerhet gör det möjligt att hantera dessa via relationella anslutningar inom regionala kluster tillsammans med andra företag och kunskapskällor.

Denna studie erbjuder såväl ett bidrag till innovationsforskning som en ökad insikt om den möjliga konkurrenskraften, hos SME inom WMC. Genom studien skapades kopplingar som sträcker sig bortom disciplinära gränser inom regional forskning, marknadsstudier och hållbarhetsforskning.

Nyckelord: *flervåningshusbyggande i trä, hållbar utveckling, marknadsutveckling, regionala innovationssystem, små- och medelstora företag*

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Abbreviations and key concepts

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DA	Discourse Analysis	17
External	Refers to aspects outside the region	4
HEI	High research institute	8
Local	Refers to aspects within the region	2
R&D	Research and Development	7
RIS	Regional Innovation System	4
SME	Small and medium-sized enterprises	3
WMC	Wooden Multi-story Construction	2

1 Introduction

This first chapter will give an introduction about the problematics that this research will focus upon. Initially, a background for the problem will be presented. Secondly, the problem which the research will address more explicitly. It is followed by the project´s aim, research questions and delimitations. Finally, the chapter ends with an illustration of the overall structure of the project.

1.1 Problem background

Our planet and societies are about to radically change in becoming increasingly dynamic and complex. Particular drivers for change can be identified as massive environmental and social challenges, such as climate changes, poverty and financial crises. Consequently, this has led to loss of natural resources, violated human rights, and reduced trust, which has enforced an urgent demand for a more extensive corporate responsibility (United Nations, 2013). Ever since the Brundtland Commission was released in 1987, on task of the United Nations, the term Sustainable Development was seeing the light of day for the very first time. Nowadays it is a well-used term among several different actors as well as representing a foundation for discussion. This has further led to a global engagement both at political and corporate level, where consideration needs to be reconstructed about established traditional thinking about short-term economic profit as the primary target but also to include aspects of long term social and environmental profit. Contemporary prerequisites for organisations activities circulate around their strivings in achieving the environments approval for their own occupation, in terms of legitimacy (Dunphy *et al.*, 2014).

In September 2015, a holistic approach was adopted by all United Nations member states to enhance sustainable development on a global level (United Nations Development Programme, 2020). The General Assembly admitted to the 2030 Agenda for Sustainable Development, which are defined through 17 Sustainable Development Goals (SDGs). The goals balance between the three dimensions of economic, social and environmental sustainability. These can be perceived as dependent on each other in the sense that if one of the goals are affected, the rest will be affected too. In order to accomplish the SDGs, it is expected and necessary for partnerships between governments, private sector and civil society to make sure we hand over a better planet for coming generations (United Nations Development Programme, 2020). A specialized agency of the UN, The United Nations Industrial Development Organization (UNIDO), is intended to support the achievement of the SDGs. By the mandate of UNIDO, it strives to support the member states to enhance an inclusive and sustainable industrial development (United Nations Industrial Development Organization, 2020). All industries are challenged by the SDGs, but in different ways, depending on what resources they use and the context for production as well as consumption.

The construction industry is not an exception when it comes to industries that are expected to proactively contribute to the accomplishment of the sustainability goals due to its major environmental impact (Wieser *et al.*, 2019, 2). This sector alone stands for around 42 per cent of all final energy consumption and 35 per cent of the total GHG emissions in the European Union (Littlewood *et al.*, 2019, 723-724).

In Sweden, 90 per cent of all single-family houses are built with wooden frames and the population in general possesses a positive attitude towards wood (Mahapatra *et al*., 2012, 71). Despite a long domestic tradition of wooden built single-family houses and a promising

domestic access to relevant natural resources, the current use of wood as construction material for wooden multi-story constructions (**WMC**)[1] is still slow, compared with other construction materials as concrete and steel. The promoted social beneficial effects of choosing wood as construction material can be defined as opportunities in reducing unemployment and housing shortage (Swedish Forest Industries, 2017), as well as environmental effects like energy efficiency, reducing GHG-emissions and an increased use of renewable resources (Riala & Ilola, 2014). Wood construction can also imply increased cost efficiency because of its high grade of prefabrication and shorting the building process, which is a highly cost dependable factor to have in account (*Ibid.*). Although wood is argued for being able to meet the same structural property requirements as alternative materials, the market share for WMC projects was slightly representing ten per cent, according to The Swedish Forest Industries (2017). In 2018, the share of residential apartments with wooden frames constituted approximately 13 per cent while concrete stood for 85 per cent of multi-story buildings (TMF, 2020). Hence, the Swedish WMC constitutes a niche-market. Vis-a-vis the fact that predictions of the construction for 120 000 new homes between 2018 and 2019, approximately ten per cent of these are currently flats in WMC within multi-story residential houses in Sweden (Sjöström, 2018, 27). Therefore, it can be perceived as a potential market for innovation. In return, this could generate competitive advantage for corporate actors. Related to sustainable development, environmental impact as GHG-emissions can also represent a triggering driver for increased innovation (Government Offices of Sweden, 2018).

1.2 Problem

Before 1994, the choice of wood as construction material for residential buildings exceeding two storeys was prohibited according to Swedish fire safety regulations (Brege *et al*., 2013). After the restrictions were lifted, all materials that could meet the requirements according to the national building code, became permitted for multi storey construction.

However, despite these changes in the legislation, the market transition for WMC has been slow (Mahapatra *et al*., 2012). According to Gosselin *et al.* (2017), market acceptance of wood in construction is influenced by perceptions, costs, fire safety, durability, and experience level. Another vital factor that influences perceptions on wood is that concrete has a well-established position as the preferred construction material amongst professional actors in multi storey construction, which undermines the market development and promotion of wood. This can be described as a case of *path dependency* (Mahapatra *et al*., 2012). Path dependent processes occur when initial moves lead in a specific direction and tend to steer future moves in the same course (Kay, 2005). Path dependency may be reflected in contract times, procurement procedures or technological lock in-effects.

Transition to techniques that use wood in construction is perceived as a system innovation that seeks to break a path dependent trajectory. Here, institutional challenges are seen at a system level as well as at local levels. According to Mahapatra *et al*. (2012), an innovation system is an inter-linked set of technology, actors and institutions. The system goes along with a particular development path which is influenced and supported by institutional, social and economic factors. These institutions provide stability through guidance, which direct and form actors' actions. Though this phenomenon of path dependency stimulates incremental innovation, it also becomes an institutional barrier, i.e. norms, attitudes, perceptions and beliefs, for promoting radical innovation systems. Other aspects that strengthen path dependency are

[1] During this project, WMC will refer to residential buildings exceeding two storeys.

various technological and marketing uncertainties which are related to innovations, like wood as structural components in multi-story buildings (Mahapatra & Gustavsson, 2009).

More practical barriers regarding the promotion of wood as construction material in multi-story buildings, can be derived to the lack of knowledge in the field (Gosselin *et al.,* 2017). The limited diffusion of wood for this type of construction may partly be explained through the education and limited knowledge among specifiers (Roos *et al.*, 2010). The decisions by these key actors, such as architects, consulting engineers, constructors, contractors, subcontractors, and suppliers, are driven by their knowledge and experience of wood in construction. Lack of education in wood building contributes to gaps in knowledge. Consequently, these professions recommend concrete and other dominant materials instead of wood (Mahapatra & Gustavsson, 2009). Another possible reason for the slow growth of wood construction is that traditional concrete constructions are viewed by many as more familiar, comfortable and safe. By the involvement of new and unfamiliar processes and actors in a project, this could negatively affect decision-making due to a matter of uncertainty. When it comes to national building codes, the absence of relevant knowledge amongst actors related to regulations for the use of wood in construction, could also be a part of the problem (Mahapatra & Gustavsson, 2009, 7). Therefore, all these mentioned factors may result in consequences like a general reluctance towards wood as structural material in multi-story buildings by professionals (*Ibid.*).

Knowledge of multi-storey wood construction is limited among key actors in the sector. Education about wood architecture and construction has been limited compared to e.g. concrete (Gosselin *et al.*, 2017). Mark-Herbert *et al.* (2019) mean that expectations, values, and communication traditions are factors that form customers' decision-making of apartments. Due to the fact that the consumers' perceptions are highly influenced by norms of society (Ottman, 2011), these perceptions are likely to partly get coloured by professional actors' norms and knowledge. According to Roos *et al.* (2010), the understanding of structural materials in residential buildings is also limited among end-users. Disapproving perceptions are in some cases noticed where wood is seen as an old-fashioned material that is not suitable for industrial building construction (Mahapatra & Gustavsson, 2009). Uncertainty amongst end-users about the wood material's fire-safety properties and maintenance costs may also delay the market acceptance (Xia *et al.*, 2014).

1.3 Aim and research questions

The aim of this project is to identify similarities and differences in market innovation strategies for small and medium-sized enterprises (**SME**s)[2] within the industrial wooden multi-story construction sector. The project includes a qualitative multiple case study that focuses on the market development of wooden multi-story construction in Sweden. The study problematizes, as well as finds solutions to, market development challenges in wood construction. It further creates insights on how expanded knowledge and regional partnerships may generate competitive marketing strategies and sustainable value for wood construction. In order to address the aim the following research questions have been developed:

- How can SMEs in WMC use regional innovation systems for creating competitive growth strategies to promote sustainable value?

[2] The European Commission definition of enterprises with no more than 250 employees, an annual turnover of up to 50 million Euro, or an annual balance sheet total of up to 43 million Euro (European Commission, 2016).

- In what ways are diffusion of WMC knowledge concerning wood possible for SMEs related to research and development via external actors?
- How can SMEs in industrial WMC achieve market growth?

1.4 Delimitations

The study is focused on the potential for market development of industrial WMC. Therefore, it only included respondents with positions in construction companies involved in industrial wooden construction of WMC. Residential single-family construction is not included. The study is focused on Sweden.

The Covid-19 pandemic in 2020 prevented personal face-to-face interviews. Instead, a mixed method for gathering data was used including interviews over phone or videotelephony.

The theoretically based delimitations of this project are restricted to innovation system studies. One argument due to the aim of this research, is that innovation systems are most easily observed at the regional level. The reason is that distance has a tendency to decrease the frequency of interaction among different individual actors (Andersson & Karlsson, 2004). A regional innovation system (**RIS**) approach does also not focus on any particular industry or technology (Breschi & Malerba, 1997), which makes it easy to implement. The university-industry-government relationship is considered to play a key role in the functioning of RISs, which also makes the Quintuple helix model for system innovation a suitable option to this research (Etzkowitz & Leydesdorff, 2000, 111). Unlike the triple helix model and the quadruple helix, this innovation system is more inclusive. It is both interdisciplinary and transdisciplinary, which is promising for an analysis of sustainable development and social ecology. (Carayannis & Campbell, 2010). Theories of growth strategies, according to the Ansoff matrix (Johnson *et al*., 2008), is used to complement and will work as a strategic planning tool.

1.5 Outline

The thesis contains eight chapters in total, which is illustrated in Figure 1.

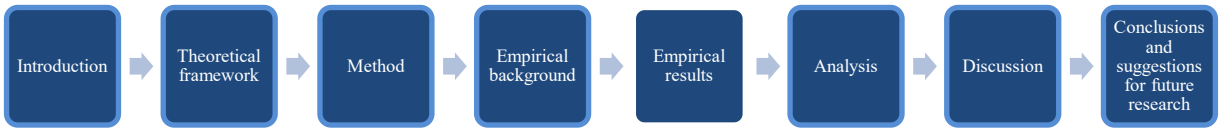

Figure 1. Illustration of the outline of the study.

This project begins with Introduction (Chapter 1), which ends with the aim and three research questions. The theoretical framework (Chapter 2) presents relevant theories, mainly focusing on market development, strategies and innovation. A conceptual framework is also outlined. Chapter 3 describes the methodological approach, which involves empirical data, ethical aspects and quality assurance regarding the research. The empirical background (Chapter 4) shows previous research and information regarding the construction sector and actors involved. Further, the empirical results are presented in the next chapter (Chapter 5). These results are further analysed with support from the conceptual framework of this project (Chapter 6). The discussion follows in Chapter 7 and finally, Chapter 8 concludes the study and presents suggestions for future research.

2 Theory

This chapter provides a presentation of the central theoretical areas which together will comprise the basis of the theoretical framework of this study and upcoming analysis in chapter five. At first, the Ansoff Matrix is highlighted concerning different growth strategies and market positions. Secondly, Regional Innovation Systems is presented and how innovation processes can be perceived as locally rooted. The development of the RIS into a Quintuple Helix Innovation System, and how this approach can promote sustainable development. At last, a conceptual framework gives a synthesis of the theoretical framework.

2.1 The Ansoff matrix – strategies for diversification

In an attempt to address how SMEs can achieve market growth and competitive growth strategies, Ansoff's matrix of present and future product and market growth was found best suited for the purpose. The reason is that it considers growth options in an explicit way. The matrix also gives an uncomplicated course of action by creating four different directions for strategic development (Johnson *et al.*, 2008). The aim of the matrix is to steer business into higher levels of growth and support in comprehending development and market strategic opportunities. Depending on which growth strategy an organization chooses to implement, the matrix also points out different levels of opportunities as well as risks, that follows with each strategy (Ansoff, 1957). Below, an illustration of Ansoff's matrix is shown in Table 1.

Table 1. Illustration of Ansoff's growth strategy matrix (Corporate Finance Institute®, n.d.)

Product / ***Market***	**Existing**	**New**	**Level of risk**
Existing	Market Penetration	Product Development	↓
New	Market Development	Diversification	
Level of risk	→		

The strategies further show distinct pathways a business can take in order to achieve future growth (Corporate Finance Institute®, n.d.). Hence, Ansoff's matrix is divided into four quadrants representing the respective strategy (further presented in 2.1.1 – 2.1.4). The increased risk for each strategy is shown by the direction of the arrows. It is worth highlighting that organizations in reality not just follow one of these paths, but several of them simultaneously. However, it is also worth mentioning that a certain option of an organization, which has shown itself as successful, does not per se implies that this option is necessarily optimal for other organizations (Ansoff, 1957).

2.1.1 Market penetration

The aim of market penetration is to increase company sales without restructuring the primary product-market strategy of the company. Growth may occur by marketing the existing product in a different way on the existing market. Hence, it is a strategy that implies less investment which in return results in a lower risk-taking for the organization. A market penetration can be considered as a desirable option if the market is not saturated or whether it is possible in just

maintaining market share for gaining growth. Conditions for initiating this strategy, the organization need to possess a competitive position in order to prevent retaliation from competitors (Johnson *et al.*, 2008).

2.1.2 Market development

Johnson *et al*. (2008) explain market development as a growth strategy which involves delivering the existing products of the organization into a new market. It is however vital that the strategy fulfils critical success factors concerning the products or services instead of launching the traditional offers on the potential market. Otherwise, the strategy is likely to fail. This strategy further characterises three distinct forms regarding the focus phenomenon of a new market; new segments, new users, and new geographies. Concerning strategic capabilities (*Ibid*.), it is common that market developers lack the necessary marketing competence to be successful, and crucial knowledge about the different forms in the new market, which also likely may have different needs the organization must answer to.

2.1.3 Product development

During a product development growth strategy, a modified or new product or service is offered to an existing market. Unlike the market penetration, which also in some degree may include product involvement, there is a far higher level of innovation involved. Because of this, it may also likely include higher costs and an increased level of risk for the organization (Johnson *et al*., 2008). Reasons for that, is that the strategy requires access to new strategic capabilities, like new technologies, which must be invested in to obtain. Even if the organization already controls this basis, the strategy also indicates a project management risk due to lack of customisation and eventual delays. If expenses and the degree of risk are too high for the organization, the market development strategy may be a more preferable option (*Ibid.*).

2.1.4 Diversification

To achieve diversification, the organization must move from its point of departure in existing products and markets towards undiscovered areas (Johnson *et al.*, 2008). Unlike the other growth strategies above, a diversification growth strategy takes place with a new product on a new market and is commonly associated with restructuring in characteristics regarded to the product and/or market of the organization (Ansoff, 1957). Hence, this is the most radical strategic and riskiest path the organization can take. However, it is also considered that there is a lot to gain if the strategy happens to be successful, such as efficiency gains, stretching corporate parenting capabilities, and increasing market power.

2.2 Regional innovation systems

According to Lundvall (1995, 2), systems of innovation are constituted by the relationships and elements that interact in the production, diffusion of innovative knowledge that is economically useful. According to multiple literature sources, regionalisation is perceived as an important component in a world of increased global competitiveness (Asheim & Isaksen, 2002, 77). Regionalisation can further be defined as an instrument to achieve knowledge about the dynamics of industrial development and regional economic development. Regionalisation also emphasizes that economic growth and innovation are not thought to occur in geographic spaces that are completely homogeneous. Rather, it is regarded to arise through locally rooted aspects from social embeddedness, interactions with local institutions and changes of ideas among individuals and spatial proximity (*Ibid.*).

Since 1990, the interest for regional innovation systems (**RIS**) have grown rapidly to be representing one of the most influential concepts in the context of regional science studies (Belussi *et al.*, 2010, 711). Grundel and Dahlström (2016, 967) argue that an innovation can be derived and understood as a consequence from social processes which arise in different actors' interaction between each other. Therefore, RIS is closely interconnected to the occurrence of regional clusters and innovation policy. Unlike national innovation systems (NIS), the focus of a geographical area is considered differently by the RIS. When it comes to appropriate levels of implementing innovation policies, the RIS regards regional level as a desirable geographical delimitation.

The relevance of RISs in this project can be clarified through the university-industry-government relationship that is perceived to have a key role in the functioning of a RIS. This relation is defined by Etzkowitz & Leydesdorff (2000, 111) as the triple helix system. Universities have a major role in RISs as a knowledge provider to companies. Except for these institutions, also High Research institutes (**HEI**s)[3] are vital for the RISs. This group consists of application-oriented, and non-university research organizations which keep the regional firms up to date with scientific solutions (Koschatzky, 2001, 3). The author further highlights two functional abilities of HEIs in a region. Firstly, the management of a common knowledge base of the region by creating and the diffusion of knowledge via education. It does that through the distribution of scientific and technological information and transferring scientific solutions. Secondly, it helps to provide expertise knowledge via training, consulting, seeing to the needs of the individual actors, and transfer of services.

According to traditional RIS, it has highlighted local sources of innovation as an utterly vital aspect. However, more recently research has found it as more crucial to access knowledge and innovation through external channels, *e.g.* research and development-competence (**R&D**) on both national and global level. The outside of the local industrial environment can be regarded as enhancing technological change and innovation processes, which Asheim and Isaksen (2002) claim to be an important aspect to regard for a great number of SMEs in general. The concept of RIS has also recently been object to initiatives from the European Commission regarding directives to evolve more efficient prerequisites for reaching set European goals in research and innovation by 2020. European regions are supposed to enhance research and innovation by creating Smart specialization strategies (RIS3) which purpose is to enforce pre-existing regional specializations (Grundel & Dahlström, 2016, 967).

One critical point of view related to RISs, can be considered as to what extent innovation policies allow inclusiveness of different stakeholders. Grundel and Dahlström (2016) also highlight critiques towards previous understandings of RIS, and the actual restricted involvement of actors it includes. This has further led to arguments of innovation policies as too narrow and unfair due to the risk of excluding many important actors. The authors also point out risks as lack of gender equality with respect to earlier trends where clustering between male-dominated heavy industrial members may result in putting a label on innovation through transmitted values and norms as masculine activities. Despite this critique, a lot of researches believe that there are economic advantages by extending the allowance to other different groups for participating in innovation policies as RIS. By doing so, new ideas and values will likely arise which can enhance the innovation processes (Appelstrand & Lidestav, 2015). By giving the possibility for civil society to get involved, this could result in more democratic manners inside RISs.

[3] High research institutes support companies with updates of scientific solutions and enhance industrial transformations when innovative technologies are presented (Koschatzky, 2001).

Responses to the critique above, can be found in the development of the former triple helix based on collaboration mainly involving universities, government and industry, into more inclusive innovation systems towards other stakeholder groups as well. As an extension of the triple helix, the quadruple helix system also includes civil society as an additional subsystem. For this fourth helix, different NGOs are often representatives of individuals or groups, but it could also be citizens and labour unions (Grundel & Dahlström, 2016, 969).

2.3 Quintuple helix innovation systems

The Quintuple helix model for system innovation was developed by Carayannis and Campbell (2010) and it is based on the origin of the triple helix model and becomes an extension of the quadruple helix model. Unlike the quadruple helix, it further expands to also include a fifth helix, the natural environment of society. Hence, this approach implements a broader context about the importance of sustainable development and socioecological factors in the relationship between society and nature (*Ibid.*). One of the most contributing concepts of importance concerning the model, can be perceived as its urgency of aim to preservation, survival and vitalization of mankind. The circulation of resources of knowledge between the different social subsystems, know-how and changes in innovation in society and economy, is another important function of the model (Carayannis *et al*., 2012). Carayannis and Campbell (2010) also highlights that the model is regarded as both interdisciplinary and transdisciplinary at the same time, which creates opportunities of using it for analysis of sustainable development and social ecology. The subsystems of the quintuple helix model are illustrated in Figure 2.

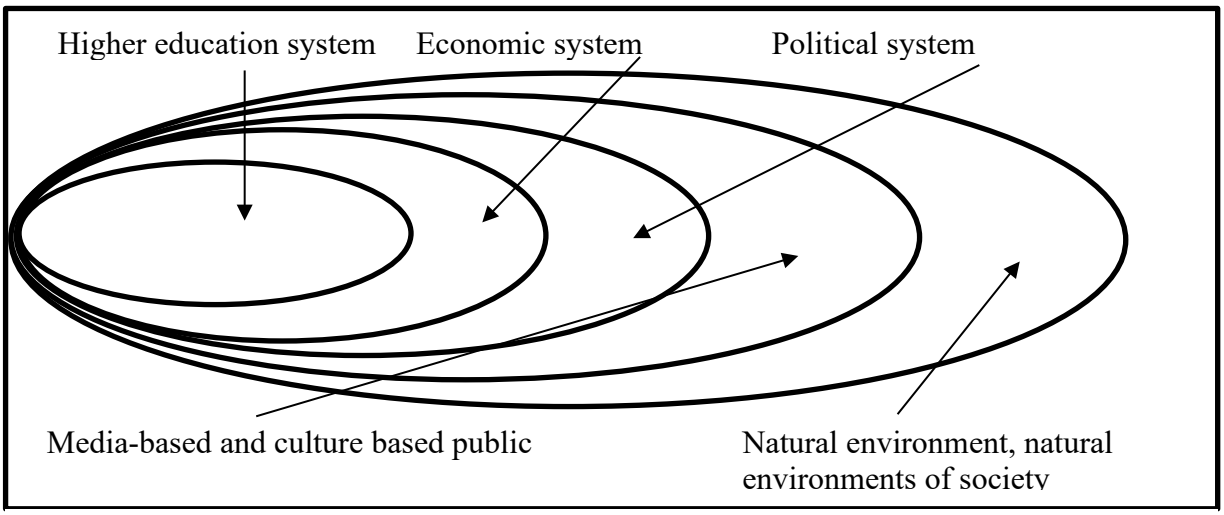

Figure 2. Illustration of the subsystems of the Quintuple Helix model (with minor modifications, Carayannis et al., 2012, 6).

Due to the process of circulation, it further visualizes the collective interaction and exchange of knowledge in a state by following five different helix subsystems (Carayannis *et al.*, 2012). The first subsystem comprises human capital in the educational system, which can be defined as schools, universities and higher academical systems. These are further formed by the diffusion and research of knowledge. The next subsystem is the economic system which constitutes for companies, industries and banks with a focus on economic capital. The third helix is the political system, which can be regarded as another important subsystem due to its political and legal capital like laws, politicians, ideas and so on, and formulation of "will". The national state further defines, organizes and administers the overall conditions of itself when its heading into the present and future. The fourth subsystem is the media-based and culture-based public which constitute for two capital types where the first defines as capital of information as

television, internet, newspaper and so on, while the latter comprises social capital like traditions, values and visions. Both are integrated with one another and count as representing civil society in general. The fifth and the last helix is the natural environment which is a cardinal component with its natural capital like natural resources and biodiversity, for the enhance of sustainable development (Carayannis *et al*., 2012)

By applying the quintuple helix model in this project, the aim is further to put nature in a central position of innovation and knowledge production related to the environment of the SMEs. Innovation system models like the quintuple helix are perceived as a tool for handling socio ecological challenges, for example global warming. Through specific sub-systems, like on a regional level, production of knowledge-to-knowledge is bound to it. Hence, connected links with RIS can be identified, and integration of these innovation systems are thereby possible. By embracing a socioecological perspective, it can be found as a crucial process for being able to apply a focus on sustainable development due to a better understanding of the relationship between factors as societal knowledge and innovation in a regional context (Grundel & Dahlström, 2016). Each of the quintuple helix subsystems include a unique and required asset to provide when analysing sustainability in the model (Carayannis *et al.*, 2012).

2.4 A conceptual framework

Previous theories build a solid frame and function as an analytic tool for the empirical findings. With a focus on market innovation strategies in SMEs, related to WMC, can use innovation in promoting sustainable development. The different theoretical approaches are gathered relative to the environment of the case-SMEs. The theories are considered as capable to contribute with relevant fragments that together will help in answering the actual research questions (Figure 3).

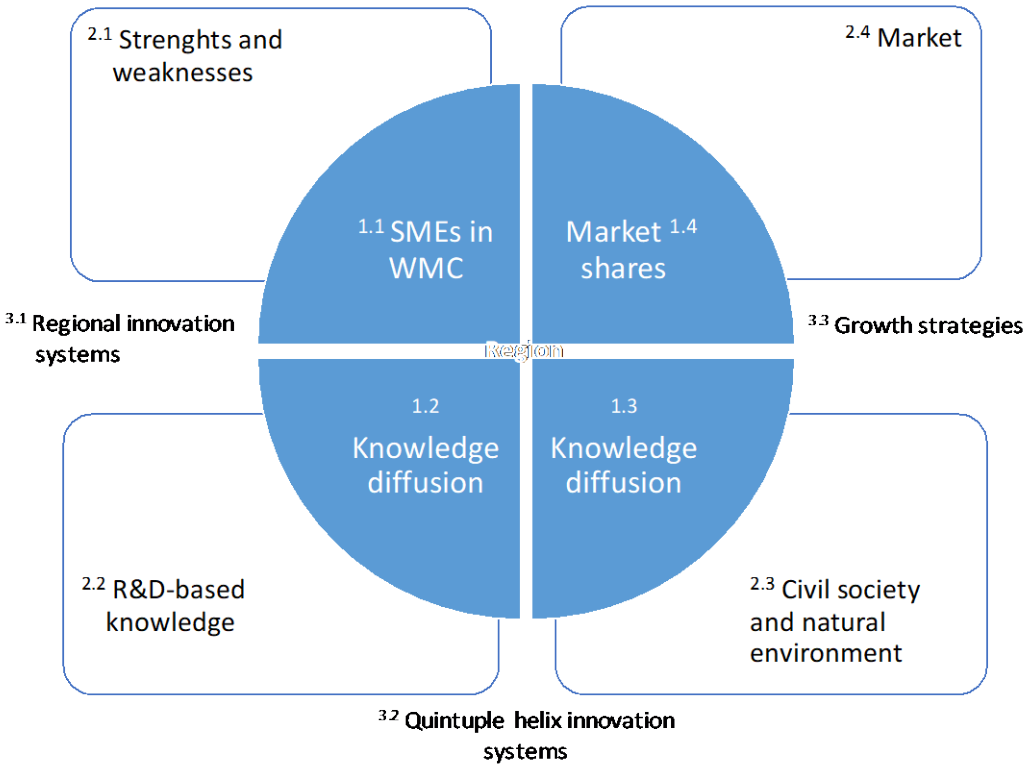

Figure 3. A conceptual framework of theoretical point of departures regarding to the analysis process.

The Inner circle of the conceptual framework constitutes the regional sphere, where the case-SMEs (1.1) manage their business. It further makes the environment where diffusion of local knowledge evolves by the interaction and activities between the SMEs and other actors (1.2;1.3). It also includes achieved market shares from the construction market by the SMEs (1.4).

The outer quadrants resemble factors that do not exclusively belong to the regional sphere but are connected through interdependent factors to it. It includes supposed strengths and weaknesses of the SMEs, *e.g.* specific factors that affect the competitiveness (2.1), R&D-based knowledge, such as expertise from national and international actors, *e.g.* governments and R&D-institutes (2.2), civil society and the natural environment, *e.g.* NGOs and natural resources (2.3), and the market, *e.g.* present and future products and markets (2.4).

The RISs (3.1) are perceived as a link that are supposed to enhance the diffusion of knowledge by involving other actors to interact, both local internal actors but also influences from external channels (*e.g.* Asheim & Isaksen, 2002; Appelstrand & Lidestav, 2015; Grundel & Dahlström, 2016). Moreover, RIS will be integrated with The Quintuple Helix Innovation Systems (3.2), which will support the achievement of a broader perspective of sustainable aspects, and which extend the diffusion of knowledge further by including involvement from civil society and the natural environment (*e.g.* Grundel & Dahlström, 2016; Carayannis & Campbell, 2010; Carayannis *et al*., 2012). The quintuple helix innovation system is perceived as an efficient framework for transdisciplinary analysis of sustainable development and social ecology, which may be desirable for the studied phenomenon of the activities from regional SMEs involved in WMC, and the promotion of a more sustainable society. Regarding to the Ansoff Matrix, it will provide an overview of the market situations that are presented and of what the analysis will present (*e.g.* Ansoff, 1957; Johnson *et al*., 2008). In combination with increased knowledge about WMC construction, competitive growth strategies (3.3) may evolve inside the local clusters which possibly could increase the market shares of WMC. The conceptual framework is structured as a cyclic model to illustrate that this is a continuous process that needs to be maintained.

The conceptual framework is used during the analysis process (Chapter 6). In the following chapter, method, this framework serves as a structure for the development of an interview guide.

3 Method

This chapter gives an overview of the various use of methods in which this paper has been structured upon. Presentations of the research's approach, unit of analysis as well as how data has been collected are shown both with a literature review, semi-structured interviews, quality and trustworthiness aspects and eventual ethical considerations of the project.

3.1 Research design

This project will try to identify similarities and contrasts across the selected cases regarded to market development within WMC. Robson and McCartan (2016) explain flexible design as a progressive work which can be adapted as the research evolves. Refinement of the theoretical framework was further perceived as vital to enhance research of good quality. Therefore, a flexible case study was found appropriate for this project. Carefulness was vital not to let the flexibility reduce the thoroughness in which the processes of the project was rested upon (Yin, 2009).

As a suitable complement, abductive reasoning enables cycling between theory and the observations, according to Robson and McCartan (2016). The authors point that the reason for its appropriateness depends on the heavy reliance on the interpretations of the researcher that follows a flexible design. Otherwise, risks of neglecting alternative explanations of data is impending. On the other hand, this approach also let the researcher uncover and rely on the best possible sets of explanations to understand the results of the research (Plomp, 2013). A flexible design in combination with an abductive approach further helps the researcher to increase the trustworthiness of the research. It also gives the possibility to use triangulation through its typically use of multiple qualitative data collection techniques (Yin, 2009).

3.2 Literature review

Literature review is an effective tool to identify gaps in the field that is under research. In return, the research may involve higher quality of analysis and eventual contributions (Robson & McCartan, 2016). This case study was supported by earlier literature research which could be counted as relevant for constituting a point of departure for the actual research. These can be referred to academic journals concerning market development derived from the Ansoff matrix, regional innovation systems, and quintuple helix innovation systems.

Literature specifically related for implementing a discourse analysis approach has been retrieved from authors, such as Harding (2015), Alvesson and Kärreman (2000) and Höglund (2013). In this project, the collection of articles in journals was partly acquired by using computer-based search from the databases of Google Scholar and Primo. Remaining secondary data consist of other journal publications, reports, newspapers and electronic web-sources of relevance to this research. Statistics were achieved from organizations, such as Sweden Statics (SCB), the Swedish National Board of Housing, Building and Planning (Boverket), and the Swedish Environmental Protection Agency (Naturvårdsverket). Consultation with my supervisors and respondents from the case companies was also continuously taken part of the process by providing their expertise knowledge about the subject.

3.3 Qualitative case study

The definition of a case study, according to Yin (2009, 18) *"A case study is an empirical inquiry that investigates a contemporary phenomenon (the "case") in depth and within its real-world context, especially when the boundaries between phenomenon and context may not be clearly evident."*

According to this statement, a case study as research strategy seems preferable when it comes to some specific situations. The first situation can be described as when the research addresses descriptive or explanatory questions, such as designed in terms of "how" or "why". A case study is also appropriate when a researcher examines contemporary as opposed to entirely historical events, but when relevant behaviours cannot be manipulated. Similar to the techniques of a history, but different from two other aspects, the case study also involves direct observations of the studied events and interviews with persons related to the events. Therefore, there exists abilities of dealing with various sources of evidence (Yin, 2009).

This project used a case study approach due to its focus to create understanding toward particular real-world cases that may involve relevant contextual conditions to events within the market development of WMC. A case study was also seemed desirable due to the research question designs, such as *how* SMEs may use RIS for creating competitive growth strategies, or *how* can SMEs achieve market growth? The events of this project, such as present and future market development of SMEs, was regarded as contemporary events. As a researcher, control over the events can also be considered as low. Hence, a case study seems to be a preferable research method.

However, there were also some notified risks with the conduct of a case study in general. For instance, subjective biases may evolve which risk the reliability of the research, and restrict the findings (Yin, 2009). Eisenhardt (1989) also mentions that case studies are likely to create premature conclusions. Another risk is deficient decisions concerning to the choice of a suitable framework (Dubois & Gadde, 2002).

A case study can either compose a single or multiple case study. While single case studies focus on one case alone, multiple case studies allow the researcher not just analysing the data within each specific situation, but also across several situations (*Ibid.*). Because the aim of this project was to investigate how enterprises involved in WMC were able to enhance market development, one case was not likely to represent differences and similarities in how this emerged. According to Campbell (2009), a comparative case study has a detailed focus on the context and features of multiple instances of a specific phenomenon. The goal within this form of case study was further to discover contrasts, similarities, or patterns across the cases. Given that the project was focusing on several case companies within the same industry, a comparative case study was perceived as appropriate for this research.

Another aspect to have in mind was that a case study can either follow a fixed or flexible design. During the process of data collection, important revelations may emerge which makes it necessary in modifying the initial design of the case study, which could perceive a closed design as problematic. One example concerning multiple case studies can be that preconceptions about parallel cases as literal replicative, turn out not to be true (Yin, 2009).

A case study protocol was conducted for this project which can be found in Appendix 1. It is considered as a crucial document of records when conducting a multiple case study. The reason

was its ability of necessary guidance for keeping the researcher close to the topic during the data collection process. A case study protocol was also of importance for increasing reliability of the research and handling different dilemmas that may emerge during the development of the case study (Yin, 2009). According to Rahim and Baksh (2003, 32) the document should cover a project overview, field procedures, case study questions, and guidelines for writing the report.

To minimize the risks normally associated with a case study, such as reliability and subjective biases, the case study protocol and peer groups served as supporting tools for both these purposes (Yin, 2009; Robson & McCartan, 2016). When it comes to case studies, it is also possible to collect and analyse data simultaneously, according to Eisenhardt (1989). During the research process, the researcher is also allowed to go back and forth to modify the research questions and theoretical framework due to the choice to use a flexible abductive approach. Hence, unexpected findings in the empirical results may flexibly be taken care with (Dubois & Gadde, 2002).

To summarize, the research strategy of this project will be executed by a comparative case study which follows a flexible design and abductive approach. A case study protocol was also conducted for guidance and targeting the topic of the project.

3.4 Choice of unit of analysis

Robson and McCartan (2016) explain that when a flexible design is used, the sampling depends heavily on the purpose of the research. Therefore, the specific choice of SMEs involved in industrial wooden construction of WMC as a unit of analysis in this project, was worth to be highlighted. Worldwide, shifting opinions of the defining terms of SMEs have emerged which sometimes makes it quite confusing. Usually however, the definitions are mainly based on restrictions of the number of employees or financial measurements (Madani, 2018). Different approaches of SMEs are presented in Table 2.

Table 2. Different approaches of small and medium-sized enterprises (based on Robu, 2013, 84)

	Approach categories		
No.	**Criteria**	**Name**	**Dominant characteristic**
1.	Economy sphere	Generalized	Establish different defining criteria of SMEs for all activity sectors
		Differentiate	Using various criteria of delineation of SMEs by taking into consideration the field of activity, e.g. transport, telecommunications, etc.
2.	Number of indicators used	Unidimensional	Using in the definition of SMEs a single indicator. The most common indicator is the number of employees.
		Multi-dimensional	Define the size of SMEs based on several indicators. The most commonly used are the number of employees, turnover and capital.

In the criteria of economy sphere (No.1 in Table 2), the definition can either have a generalized or differentiate approach concerning if criteria of the enterprise are supposed to be independent of the associated activity sector or be defined by it. In No. 2, the criteria concern the number of indicators used in the definition. It can be either unidimensional, which defines the SME by a single indicator, such as the number of employees. Instead the multi-dimensional refers to definition by several indicators, such as the employees, turnover and capital (Robu, 2013).

The definition of SMEs by the OECD could be perceived as a generalized unidimensional approach which just considers the number of employees as the only decisive indicator (Madani, 2018). The definition of the European Commission could be perceived as a generalized approach which defines the size in a multi-dimensional way with indicators such as number of employees, turnover and active balance, in Europe. China, on the other hand, uses standards characterized by a differentiating multi-dimensional approach. The regulation divides enterprises into activity sectors, then small and middle size enterprises are split into three categories, medium, small and micro. The United States has a similar approach by taking the activities the enterprise performs into consideration. They are separated into three major domains, industry, services and agriculture (Robu, 2013). One example of different definitions of SMEs are presented in Table 3.

Table 3. Examples of SME definitions (Madani, 2018, 107)

Definition	**Criteria size**	**European Commission**	**World Bank Group**	**OECD**
Small-sized enterprise	Number of employees	< 50	< 50	< 50
	Annual turnover	≤ € 10 m	≤ € 10 m	-
	or			
	Annual balance sheet total	≤ € 10 m	≤ € 10 m	-
Medium-sized enterprise	Number of employees	< 250	< 300	< 250
	Annual turnover	≤ € 50 m	≤ € 15 m	-
	or			
	Annual balance sheet total	≤ € 43 m	≤ € 15 m	-

The table shows various thresholds concerning SMEs from the European Commission, the World Bank, and the OECD. Notable is that OECD just considers the number of employees as a criterion for the definition of a SME. Micro enterprises are also occasionally defined by these actors (MSME)[4] but because none of the selected cases was located within this definition, micro-sized enterprises were not included in this research. In eventual involvement in statistics presented, these enterprises were being counted by the term of small enterprises instead.

Other beneficial parts concerning SMEs, can be found in their ability to specialize in niche markets and being able to quickly respond to shifting demands and change (Ahmadi & Helms, 1997). Due to their more informal and flexible characteristics, SMEs also usually are more able to implement structural changeovers to promote sustainable businesses. The smaller parties of involved managers are likely to reduce long chains of command, which are not possible in the more bureaucratic organizational structure and systems of larger firms. Therefore, decision and change can be proceeded more rapidly in SMEs (*Ibid.*).

The choice of construction type, industrial wooden construction, was also needed to be explained. In more recent years, a breakthrough within the Swedish industrial wooden construction was made related to multi-family residentials, due to an increased number of investments in capacity enhancing (Government Offices of Sweden, 2018, 10). These investments involved new factories for prefabricated modules and construction systems based on wood, which enables increased production capacity (Government Offices of Sweden, 2018). When major parts of the building process are moved to factories rather than being made on the construction site, organizations are able to construct a higher number of residential housing with the same amount of resources, such as material resources, employees and equipment

[4] An extended definition of SME that also include micro enterprises. The criteria of micro enterprises are less than ten employees and an annual turnover or annual balance sheet total of less than 2 million Euro (Madani, 2018, 109).

(Swedish Office for Wood Construction, 2016). Therefore, industrial wooden construction was considered an important component in the reform to reduce environmental dilemmas and towards a more sustainable construction sector. Industrial production of residential housing was proved as a potential force to reduce some of the primary economic and non-sustainable barriers related to construction (Government Offices of Sweden, 2018).

Due to practical aspects, the selection of case companies of this project was determined according to the European Commission's (2016) definition of the deciding criterions of what could be defined as a SME. Hence, this research targeted enterprises which fulfilled the requirements of no more than 249 employees and a maximum annual turnover of 50 million Euros or an annual balance sheet total of up to 43 million Euros. Except for the criteria's above, the selection of the interviewees depended on the relevance for the subject and the research questions. Therefore, it comprised business positions which involved a central and close presence to different WMC-related projects and the strategy-creation that surrounded these. By succeeding to find the right respondents within the company or organization, it was more likely to reduce eventual misrepresentations due to a lack of knowledge, and therefore be more accurate (Bryman & Bell, 2015).

Denscombe (2010) argues that all case studies need to be selected based on the relevance to the practical problems or theoretical issues which are researched. Further, this selection will likely reflect a range of other considerations. As for this project, the selection of cases was based on the justification of typical instances. The particular cases which were selected possess crucial similarities with other SMEs that could have been selected within the industrial wooden construction business. Hence, the findings from the research were therefore likely to be applied elsewhere. The selection of cases was also based on practical considerations. Although a research never should be relied on practical factors as decisive principals or a criterion alone, these factors do have a bearing in real world research. It could be naive to consider otherwise. The selection of cases was also reasonable to contain matters of convenience. However, this criterion cannot justify the research itself, but was subordinated to the considerations of typical instances. The companies were identified and retrieved from the member-webpage of the national trade and employee association of the wood processing industry, The Swedish Federation of Wood and Furniture Industry (TMF, n.d.). The organization represents about 700 members. All respondent enterprises of this project are members of the organization. Except to fulfil the criterions of definition of the European Commission, the business of the companies was needed to involve industrial WMC. In total, 16 companies were contacted, and of these, five were willingly to participate in the project. The selected SMEs for this research are presented (Table 4).

Table 4. Small and medium-sized enterprises (SME)

Enterprise	**Location**
Isotimber Holding AB	Östersund, Jämtland
Nock Massiva Trähus AB	Ale, Västra Götaland
Älö Trä Vimmerby AB	Vimmerby, Kalmar
Spacem2 For smart living AB	Vara, Västra Götaland
Sizes Works AB	Oskarshamn, Kalmar

These five selected SMEs are involved in industrial WMC and represent the three Swedish regions of Jämtland, Kalmar, and Västra Götaland.

3.5 Collection of data

This project used multiple sources of information. Yin (2009) recommends that a flexible research design should apply triangulation to enhance its credibility. The empirical data and primary data were collected exclusively by semi-structured interviews which were performed via videotelephony through the communication tool Zoom and phone. Except to just provide background information about the phenomenon of this project, secondary data was also used to support the primary data. The secondary consists of sources from webpages, reports, articles and statistical databases.

Primary data for the case study was collected through semi-structured interviews which are a preferable structure due to its flexibility when it comes to the possibilities of validating and cross-checking information between the interviews (Bryman & Bell, 2015). Mason (2004) means that this kind of structure also is more appropriate in qualitative research which is designed to answer questions like "how" and "why". All interviews of this project are presented in Table 5.

Table 5. Interviews in the case study

Respondent	Position	Enterprise	Tools	Interview date	Duration	Validation
Janina Östling	Head of sustainability	IsoTimber Holding	Zoom	20-07-10	45 minutes	Transcript (2020-07-12)
Björn Visell	Sales manager	Nock Massiva Trähus	Zoom	20-07-15	50 minutes	Transcript (2020-07-16)
Peter Lindberg	Chief executive officer	Spacem2 For smart living	Phone	20-07-15	40 minutes	Transcript (2020-07-19)
Stefan Gustafsson	Sales manager	Älö Trä Vimmerby	Zoom	20-07-23	40 minutes	Transcript (2020-07-25)
Niklas Andersson	Chief executive officer	Sizes Works	Zoom	20-07-28	50 minutes	Transcript (2020-07-29)

All interviews were recorded and summarized. This choice was based on Bryman and Bell's (2015) argument that it is a mandatory procedure in approaches which have its focus and attention on language, as in a discourse analysis. A transcribing process was also conducted because of the advantage in being able to make repeated examinations of the respondent answers. Due to the interviews being conducted in Swedish, it was necessary to translate the data into English. Therefore, the transcribing process was proceeded with great care in order not to distort the material. The transcripts were sent to each respondent for their confirmation. Before the interviews were executed, each respondent also gave their consent about how personal information was handled, regarding the General Data Protection Regulation (GDPR).

An interview guide was also prepared which Mason (2004) highlights as an important tool for increasing the possibility of directing the respondents to stay inside the frames of the subject-area. The interview guide is further presented in Appendix 2.

Mason (2004) points to critics about information collected by semi-structured interviews. Some of it is derived from the opinion that it generates inconsistent data which makes it difficult in comparing different cases between each other. However, the author defends the method by mentioning that rather than standardisation of the data between cases, semi-structured interviewing uses logics with comparison which are based on the depth of understanding for each case.

The secondary data was retrieved by a variety of documents, such as webpages, reports and articles. Statistical databases, such as the Statistics Sweden, provided informative statistics to support arguments and ideas. According to Yin (2009), these kinds of documents enable the researcher to get an extensive access range to both quantitative and qualitative data.

3.6 Discourse analysis

A discourse analysis (**DA**) has its focus on language and the use of language, which possibly could discover themes across the interviews of this project. Even if discourse in itself is both a popular term and exists in a broad spectrum of different opinions, it is therefore also easily leading to rather confusion due to the lack of a uniform or general definition and certain ways of conducting an analysis. Because of this, both Höglund (2013), Alvesson and Kärreman (2000) arguments that it is vital for researchers to define and discuss their own view of discourse and in what way it is conducted in their own actual analysis.

A DA is more of an analytic technique (Adolphus, n.d.). It relies on the researcher to read a text in a specific way. This involves interpretation, which the method has in common with other qualitative analyses. It is worth highlighting the importance for researchers to acknowledge the possibility of alternative interpretations than their own. To include a DA in the methodological approach of this project was further justified due to its ability as a wide-ranging tool that can be applied to a range of forms of data, which include both written and spoken word. Thus, research interviews and newspapers articles are appropriate sources for this method (Bryman, 2012).

An interpretive discourse analysis considers multiple texts where these constitute bodies of discourse. Its purpose is further to identify discursive structures and patterns across the actual texts, such as enthymemes or central themes. It also explores how these structures influence and shape interpretations, actions and social practices of the agents (Hardy & Phillips, 1999; Heracleous & Barrett, 2001).

This project used an interpretive DA as a method to apply on the interview transcripts in order to identify language similarities and differences within the case companies. Harding (2015) states that it is vital to use the original transcript when a DA will be conducted. Except for that, there is a lack of guidance on how it will be conducted practically. However, one way for new users to conduct a discourse analysis is often to visualize discourse analysis. When doing this, the author suggests a set of four simple steps, in which the AD of this project followed.

1. Read the transcripts
2. Identify themes in the data
3. Identify the language that is used to construct each theme
4. Identify commonalities in the use of language in relation to the construction of each theme.

Thus, these four steps were followed to conduct the DA of this project. At first, the full original interview transcripts were read and re-read closely. During the actual interview, the respondents may contradict, refer back to earlier questions, repeat or develop their original arguments. Therefore, close-reading seemed vital to have in mind (Harding, 2015). The aim was further to identify relevant fragments where the respondents discussed the market development within WMC. In the following step, similar or contrasting themes were tracked in the usages of the respondents. During this process, a comparison table was used when searching for themes between each interview session. Data memos were also made to summarize relevant data and support the mind of the researcher during the research. Examples of identified themes are

flexibility, uncertainty, regional, and external. Next, identification of particular word and phrase use that each respondent chose to construct these themes. By marking words and phrases that could be considered as key components of the themes in each transcript, the language used during the interview was notified. In the final step, eventual commonalities concerning the manner in which the perceptions were constructed, was explored related to each theme.

3.7 Quality assurance

Another crucial matter of importance to consider was the quality of the research. Hence, a researcher needs to enhance trustworthiness by actions which can create and maintain validity and reliability. To ensure the fulfilment of these two aspects, Riege (2003) provides a perspicuous set of tests and techniques a researcher needs to address. This set was created through combined extensive literature by the author, and was summarized in Table 6.

Table 6. Application of tests and techniques for establishing validity and reliability in a case study research (based on Riege, 2003, 78-79; own modification).

Case study design tests	Case study techniques	Where the phase is applied in this research project
Construct validity	- Use multiple sources of evidence	- Triangulation of theory and data sources
	- Establish chain of evidence	- All interviews have been transcribed and secondary data was documented
	- Have key informants review draft case study report	- Each respondent receives the transcript and follow-ups for validation.
Internal validity	- Do explanation-building	- The analysis will include explanatory illustrations from the theoretical framework
	- Assure internal coherence of findings and concepts are systematically related	- Consistent use of the framework when crosschecking the findings
External validity	- Define scope and boundaries of reasonable analytical generalisation for the research	- The design is presented in subchapter 3.1
	- Compare evidence with extant literature	- Abductive approach is applied, and the theoretical framework are used in the analysis of the empirical data
Reliability	- Give full account of theories and ideas	- The research process, theories and concepts are done
	- Assure congruence between research issues and features of study design	- The design and methods of this research has been extensively reviewed in Chapter 3
	- Record observations and actions as concrete as possible	- Interviews are recorded
	- Use case study protocol	- Presented in Appendix 1
	- Record data, mechanically develop case study database	- Interviews are recorded
	- Assure meaningful parallelism of findings across multiple data sources	- The same framework is conducted in all interview and documents
	- Use peer review/examination	- Proposal seminar and opposition for the seminar draft

According to Riege (2003), construct validity establishes suitable operational measures for the theoretical concepts which are being researched. Perceptions that case studies usually have a more subjective character needs precautions from the researcher, especially when the research design and data collection is handled. Hence, this project used multiple sources of evidence, such as interviews by Zoom and phone, secondary data from webpages, articles and newspapers. Each interview was transcribed, and the transcript was thereafter sent to the respective respondent. To minimize risks for misunderstanding, the respondents were also kept

in contact with follow-ups by phone and email to be aware of how the collected data was used in the latter research process. Thus, reduction of embossed subjective judgements from the researcher was possible in this project.

The aim with internal validity in a case study is to establish the investigated phenomenon in a credible manner (Riege, 2003). This was achieved through explanatory illustrations related to the theoretical framework. To ensure consistency of the research, both primary and secondary data was analysed by the framework.

External validity focuses on an understanding and exploration of constructs, such as theoretical constructs and empirical results in case studies (Riege, 2003). To address the scope and boundaries of the research, the design was clearly defined in subchapter 3.1. The analysis of the data was continuously matched by the selected approach and the theoretical framework.

To ensure reliability, several actions were taken. Reliability is coupled to demonstrations that prove executed operations and procedures in the research as possible to be made by other researchers, who then will accomplish similar findings (Riege, 2003). This project included a full account for the research process, theories and concepts. The design and methods of this research was clarified (Chapter 3) which ensured congruence of the research. Each interview was recorded, and a case study protocol was used. Parallelism between findings across multiple data sources was achieved by using the same framework for all primary and secondary data. Finally, the research was also peer reviewed in seminars. Riege (*Ibid.*) stress that consistency may become problematic in case studies, due to the fact people are less static than quantitative measurement. This despite serious actions from the researcher. However, even if the results may differ, this may also provide a precious source of information.

3.8 Ethical considerations

Ethical issues were necessary to address regarded the research process. Kvale and Brinkman (2014) explain four ethical considerations that were of relevance in this project. These were informed consent, confidentiality, consequences, and the role of the researcher.

At first, informed consent was assured by informing about the aim, context, methods, and other relevant information about the actual research. Each of the respondents gave their approval to be interviewed and taped. The respondents were also allowed a chance not to participate, or to withdraw their participation during the research process at any moment.

Information was handled in a way which made it possible for the respondents to remain anonymous if requested. Confidentiality allowed the respondents to be informed about how the project was supposed to treat personal information about them. This was informed and granted in writing by a form according to GDPR (Appendix 3).

It was necessary to keep in mind about eventual consequences that could arise during the research process. The project was not allowed to generate negative or damaging information about the respondent or the organization it represents. Therefore, the transcript and the final version of the project both were sent to each respondent before it served as material for analysis.

It was also vital to be aware of the role that the researcher had. For example, subjective biases risk to affect the findings and conclusions of the research. How this consideration was addressed was reviewed in subchapter 3.7.

4 Background for the empirical study

The following chapter gives a brief introduction to the empirical background of the wooden multi-story construction in Sweden. Firstly, the history of wooden construction will be presented. Next, the demands of a sustainable construction sector will also be noticed as well as how it has developed until today. The final subchapter will constitute a presentation of the selected case companies.

4.1 A long tradition of wood construction

Historically, Sweden has a domestic tradition of wooden built single-family houses and a good access to relevant natural resources (Mahapatra *et al*., 2012, 71). In 1988, the European Union launched the Construction Products Directive (CPD)[5], which incorporated perspectives that understood that non-combustibility is not dependent nor a necessary condition for fire safety. Other functional requirements, such as load-bearing capacity and stability, were now also vital to address. Thus, the number of storey's in wooden buildings was no longer restricted (Östman & Stehn, 2014). This further led to CE marked products. However, while CPD had to be implemented through national law, and therefore was not compulsory, it could not be applied in a harmonised way throughout the member states. This led to CPD later was repealed and revised by the European Construction Products Regulation (CPR)[6], in 2013. This new regulation applied directly without need for national transpositions, which addressed the flaws that the previous CPD could not address. The revision was perceived as necessary to remove remaining technical barriers to trade in the member states of the EU. It further lay the conditions for making construction products available on the market (EFCC, 2015).

Since 1994, it was again permitted to use bearing material of wood in multi-story buildings in Sweden. However, consequences of the period of ban, knowledge and experience of wood had suffered for the benefit of dominant construction materials, such as concrete and steel. Concrete for example, had become a market leading material which construction sector actors had already created associated working methods with (Brege *et al.*, 2013).

From a relatively low demand on residential multi-story buildings in the beginning of the 20th, new conditions slowly started to emerge (Government Offices of Sweden, 2018). Due to the fact that the Swedish government had deprived wood of its status as a construction material with 1874 years of restricted buildings codes, it fell naturally that this actor was supposed to restore its reputation (Swedish Agency for Economic and Regional Growth, 2019). Sweden was therefore one of the first European member-states that was implementing the CPD in the new Swedish building code of the Swedish National Board of Housing, Building and Planning. These reforms meant that all materials, including wood, as bearing material were accepted, as long as the actual material fulfilled the requirements of the national building code (Östman & Stehn, 2014). The Ministry of Enterprise and Innovation submitted a proposition in 2002 to create a national strategy, *More wood in construction*, to enhance wood construction in Sweden. The Swedish government perceived this as an opportunity to develop products and systems to

[5] A former European Union directive in order to remove technical barriers in the member-states. Due to not be compulsory, it was later revised by the European Construction Products Regulation in 2013 (EFCC, 2015).

[6] Regulations for the marketing of construction products in the European Union. It provides mutual technical terms to estimate the performance of construction products. The aim is to ensure that trustworthy information is accessible to professional actors, public authorities, and consumers. By providing this, actors are able to contrast the product performance from various manufacturers within the member states of the union (European Commission, n.d.).

better promote wood as a construction material on the market, where steel and concrete had long been market leaders. The strategy was further supposed to generate innovative wood construction products (Ministry of Enterprise and Innovation, 2004). The government implemented it in 2008 by various actions, such as increasing competence and innovative knowledge, and experience building. including the development of several different wooden construction systems (Government Offices of Sweden, 2018).

4.2 An urgent need of new and sustainable housing

Both demographic changes and population growth contribute to the development of Swedish residential building construction (National Board of Housing, Building and Planning, 2019). This development from the last 19 years (2000 – 2018) are presented in Figure 4.

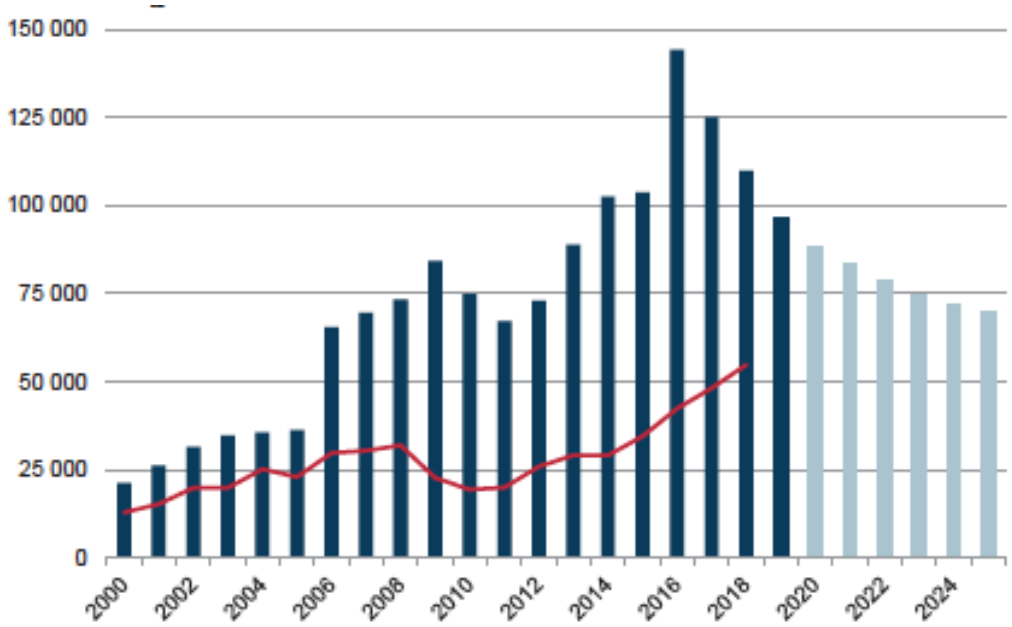

Figure 4. Population development (blue pillars) and completed housing (red line) relative to the number of individuals (vertical axis) during 2000 – 2018 (horizontal axis), in Sweden. (National Board of Housing, Building and Planning, 2019, 11).

Figure 4 presents an increasing population development which reached its peak of almost 150 000 individuals in the beginning of 2016. Afterwards, the population growth successively has decreased each year. The period between 2019 – 2025 is an estimated forecast. However, the decrease in population is thought to continue. The number of completed housing achieved the highest number, approximately past 50 000 housings, in 2018. Despite the increase, it is evident both variables do not balance due to a deficit in new housings (National Board of Housing, Building and Planning, 2019).

Related to the increase of completed housings in Sweden in 2018, the construction of new residential apartments decreased by 10 per cent in 2019 (Sweden Statics, 2019). During the first quarter of 2020, housing construction was also slowed down due to the wake of the corona pandemic (National Board of Housing, Building and Planning, 2020).

On the other hand, except for the urgent need of new housing related to the population development, sustainable value is also a vital factor driven by climate conversion (Schubert, 2019). The construction and material processes are responsible for a large amount of the GHG-emissions in Sweden (Swedish Office for Wood Construction, 2016). During 2012, these

emissions was equaled half the emissions caused by the Swedish private carpark the same year, according to calculations by the Royal Swedish Academy of Engineering Sciences (IVA). However, most of the earlier debate exclusively concerns the latter emissions that are caused after the building is constructed. The research by IVA also reveals that half the released emissions actually are caused during the building process (IVA, 2014). The environmental impact from the Swedish construction and real estate sector accounts for a significant part of the society. An illustration of the current impact is shown in Figure 5 (*National Board of Housing, Building and Planning*, 2020).

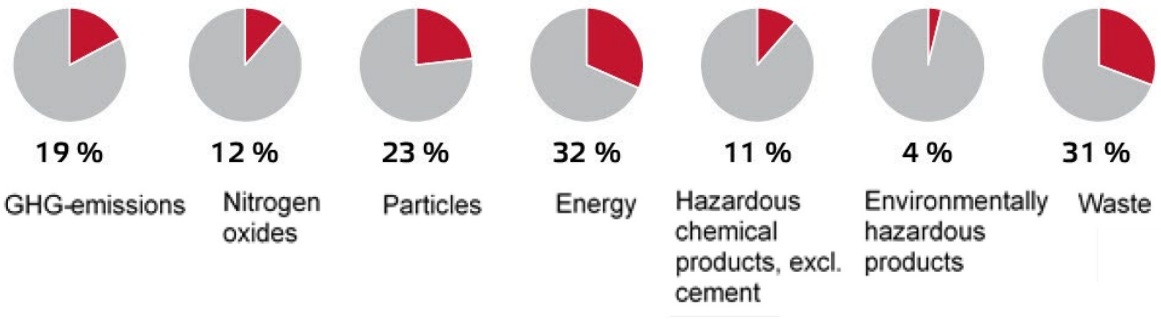

Figure 5. Illustration of environmental indicators within the Swedish construction and real estate sector, 2017 (National Board of Housing, Building and Planning, 2020, 3)

The figure shows the latest available environmental indicators that are derived on basis from Statistics Sweden. In total, 10 – 30 per cent of the country's environmental impact is caused by the sector alone. In addition, emissions are also caused beyond the national borders due to Swedish import of construction products. The indicator of waste is derived from the Swedish Environmental Protection Agency due to lack of uniform detailed industry-based statistics available (National Board of Housing, Building and Planning, 2020, 3).

4.2.1 Regional development and industry research projects

In 1975, the European Commission launched the European Regional Development Fund (ERDF) to enhance the development and structure of regional economies, economic change, territorial collaboration and competitiveness of its member states, by financial support (European Commission, n.d.b). The Swedish Agency for Economic and Regional Growth (SW: Tillväxtverket) claims that the national wooden construction strategy, regional development and industry research projects, which has followed in its trail, has enhanced the position of wood as a construction material. Previously, EU contributed approximately 90 million SEK to subvention these regional development projects with the ambition of enhancing competitiveness of the forest industry. Several of the projects were built on the triple helix model where regional partnerships between academia, various types of SMEs, and governmental agencies emerged. During the present program period, the funding from ERDF continued to increase (Swedish Agency for Economic and Regional Growth, 2019).

However, the role of ERDF is under debate. Göran Brulin, professor in local and regional innovations at Linköping university, was formerly employed at the Swedish Agency for Economic and Regional Growth where he evaluated the ongoing ERDF-project. He is skeptical that most of the funding supports research rather than to create innovative business ideas. The primary ambition is supposed to achieve local practical actions within business ideas, and not scientific articles about what is going on within the frames of ERDF. This critique has further led to a more central position of the companies needs in the present program period. Therefore,

a good balance had now been laid between investments in wood innovation and supporting the business community in the right way, according to Göran Brulin (*Ibid.*).

4.2.2 Industrial wooden construction

Industrial wooden construction can be defined as a form of industrialized building, which in turn is referred to as a modern method of construction (MMC). Unlike traditional on-site building, industrial wooden construction constitutes offsite construction with prefabricated components for elements and complete houses (Brege *et al.*, 2013). The construction method is also considered as an important component in the reform to reduce climate change, and towards a more sustainable construction sector (Government Offices of Sweden, 2018). When major parts of the building process are moved to fabrics rather than the construction site, organizations are able to construct an extended number of residential housing with the same amount of resources, such as employees and equipment (Swedish Office for Wood Construction, 2016). In more recent years, a breakthrough within the Swedish industrial wooden construction was made due to an increased number of investments in capacity enhancing. These investments have involved new fabrics for prefabricated modules and construction systems based on cross-glued wood, which enables increased production capacity (Government Offices of Sweden, 2018). Despite a clear reduction in residential construction in 2019, the market shares of glulam as an industrial construction material, has also increased with 10 per cent in the first quarter the same year (Svenskt Trä, 2019).

Industrial production of residential housing has proved itself as a potential force to reduce some of the primary barriers related to construction. It is thought to short the construction process, improve quality, and decrease costs for new residential buildings. Another positive side effect that may follow with a more advanced industrial wooden production, is that fabrics will likely be located close to the natural raw materials. This would mean that it would contribute in the development of smaller communities and countryside, by the creation of new job opportunities and sustainable growth (Government Offices of Sweden, 2018; Swedish Office for Wood Construction, 2016). Prefabricated modules, such as glulam beams, are also expected to diminish transports of material to the construction site, which both reduces carbon dioxide emissions and costs (Träbyggande.se, n.d.).

However, one of the major barriers in the construction sector for the market development of wooden construction, was remarked to be lack of knowledge and the diffusion of it. The reason for that was identified to be the dominant position that construction materials as concrete and steel possess, has influenced many actors, especially in functional and safety regulations. The national strategy for wooden construction that was launched in 2004, paved a promising path for collaboration and dialogue between the wood industry, the societal construction industry, and other essential actors. However, what is important is that these processes continue to generate the right conditions for a developed industrial construction with wood as construction material (Government Offices of Sweden, 2018).

4.2.3 Small and medium-sized enterprises

Due to more flexible business models, SMEs achieve abilities that enable them to broaden their offer concerning wood as a construction material. By the promotion of both sustainable and business value related to wood as a construction material, larger companies may follow the same path (Svenskt Trä, 2019). Larger construction companies have made extensive investments in more traditional construction systems. However, these investments are highly capital intensive and include a long lifecycle. Therefore, new investments are heavily associated

with a higher level of risk and uncertainty. This will likely result in an unwillingness to change existing activities, also partly due to perceptions of aspects linked to increased costs and time consuming. When it comes to investments in industrial wooden construction systems, this is likely perceived as both expensive and involves higher risks (Government Offices of Sweden, 2018).

However, considering factors like highly capital intensive and access to knowledge, may also be problematic for SMEs. As a result, underinvestment may lead to market failures, partly due to asymmetric information and incomplete capital markets. SMEs can get exposed to this type of financing gap risk, which also has a geographical dimension where the supply of capital is particularly strained in sparsely populated areas. Aware of these risks, government and research institutes try to support the companies by various regional company support. Investment support is also provided to encourage investments that might not otherwise have been made, especially in machinery, buildings, salaries and R&D. The aid is intended to strengthen the competitiveness of companies, but also to promote sustainable regional growth (Swedish Agency for Economic and Regional Growth, 2019).

4.3 Small and medium-sized enterprises in wood construction

Five Swedish SMEs in industrial wooden construction participated in this study. Below follows a brief presentation of the respective company as a background to the following empirical chapter.

IsoTimber Holding AB is located in Östersund, in the region of Jämtland. The concept of the business is to provide construction technology for insulating and load-bearing wooden walls to houses. These unique building systems exclusively use wood and air for this purpose, which further eliminate the need of using plastic wrappings for the insulation. Planar wall elements are rationally prefabricated in the factory in Östersund and are then transported to the building site on truck. The framework for any type of building can be produced, schools, villas or multi-story buildings (Isotimber, n.d.). The company highlights sustainable development as a vital aspect, such as that the promotion and use of renewable resources like wood as construction material, reduce GHG-emissions (Isotimber, 2016).

Nock Massiva Trähus AB is located in Ale, in the region of Västra Götaland. The main business of the company constitutes residential multi-story buildings in massive wood through modern and rational volume construction technology, to both private and public customers. Through a flexible building system with prefabricated products, Nock is able to reduce its lead times. In return, this strategy also reduces the costs of the company. On the production site in Älvängen, about 96 per cent of housing is prefabricated before it is delivered to the customer. The entire product and production process are characterized by a genuine effort to maximize the environmental benefit and minimize the environmental footprint (Nock, n.d.).

Spacem2 For smart living AB is located in Vara, in the region of Västra Götaland. The driving force behind the company is to be perceived as a little smarter alternative than on-site constructed housings. By using a unique business model, the company both can maintain a competitive price level as well as good quality products. The entire production process is equalled with a car factory, by which craftsmanship-thinking combined with solid wood knowledge, aims to create environmentally friendly manufactured houses. The company strives to just use domestic produced materials, and to develop and inspire sustainability to people in the local areas where the business is conducted (Space m2. n.d.).

Älö Trä Vimmerby AB is located in Vimmerby, in the region of Kalmar. It works with Lean thinking which is based on the concept of the company. With the support of a unique MPS system adapted for the wooden house industry, it works to create a smart and cost-effective production. Through combinations of profitability, environmental considerations and social commitment, the company also wants to promote sustainability. The five defined priority areas of the company are its customer, employees, effective production, society, and owners (Älö Trä Vimmerby, n.d.).

Sizes Works AB is located in Oskarshamn, in the region of Kalmar. The company was founded due to the purpose and idea of building ready-made volume elements in a factory that is then assembled on site. Therefore, it builds and assembles modern multistory buildings with high quality at a lower cost with a focus on the future. To achieve this, almost the entire process takes place in a production facility which aims to save as much time as possible. The company produces everything from apartment buildings to offices and community buildings with a focus on the social space (Sizes Works, n.d.).

In the following chapter, the empirical results of this project will be presented.

5 Empirical results

This chapter contains the empirical findings of the project. These results are derived from the primary data that has been collected from the interviews and secondary data that is available on their webpages. Each case-company is presented separately. Initially, strategies for market transition of each SME is presented, followed by an account for involvements in the projects, partnerships, and R&D, where each SME interacts. Next, the respective strengths and weaknesses of the SMEs are presented. The last subchapter presents future goals, the desirable future of the industry, and links to sustainable development within the industrial wood industry.

5.1 Strategies for market transition

This first subchapter is related to research question one and three, which concerns how SMEs can use RISs to create competitive growth strategies to promote sustainable value and achieve market growth. It also describes how SMEs within industrial WMC can achieve market growth compared to large enterprises. The identified strategies for market development of each SME, are presented in Table 7.

Table 7. Identified strategic focus for market transition of the SMEs

SME	Strategic market focus
IsoTimber, Östling (2020)	- Increase the number of large reference projects - Long lifecycle through reassembly - European Technical Assessment - Well-informed customers
Nock Massiva Trähus, Visell (2020)	- Customer invitations to fabric and projects - Full capacity in current fabric - New fabrics
Älö Trä Vimmerby, Gustafsson (2020)	- Broadening the customer base - Different building methods - Partnerships with volume producers
Spacem2 For smart living, Lindberg (2020)	- Cutting edge architecturally, technically and environmentally - Flexible adjustment toward customer - Sales for the long term and secured placement in the factory - Double the turnover
Sizes Works, Andersson (2020)	- A few customers instead of many - Reach a certain market share - Continuous clear growth - New markets abroad

The content in Table 7 is further explained below.

Östling (2020) believes that the major factors to increase the market shares are to run a variety of tests on the wooden products. The tests specify the performance of their products and yield larger reference projects to show potential partnership building actors. When these aspects are achieved, it is all about good contact with customers and market the product as much as possible. By partnership, such as an elderly home project in partnership with the construction and civil engineering company PEAB, reference projects will be possible to obtain for the company. Due to lack of suitable standards or declaration of performance for the unique product, it is also important having enough resources to achieve an European Technical Assessment (ETA), i.e. enables an own CE-marking of its products. Through this, the customer gets more facts about the new product that increases the confidence in it as well as in the company. Then, it is about continuing to develop the product and other small developments, such as production adjustments. Also, the company will focus on reassembly. By extending the

life cycle of its products, it allows the forest time to grow back again during the lifetime of the material in the buildings. It is not just about recycling the particular type of wood, but also reusing the products. The respondent thinks that this will differentiate them in the future (Östling, 2020).

Today, Nock Massiva Trähus has a capacity in the factory of 500 volumes, volume elements or modules, per year. The company has two goals for market development, according to Visell (2020). The first is to fill this capacity, so that they can maximize the performance in the factory. If this stage is promising, the second goal will be to go from 500 to 1000 volumes. Then it could be actual to build or hire local facilities to function as new factories. After that, the know-how of the employees is the most important aspect. The company has built two houses close to the factory, one of which is a small municipal apartment building for young adults. The respondent stresses that it is difficult to get a customer without letting them visit the factory and inspect complete or on-going projects, so now they have many such visits (Visell, 2020).

Älö Trä Vimmerby wants to broaden their customer base, according to Gustafsson (2020). Therefore, they have focused mostly on different building methods, such as using loose timber, build in blocks, and build in volumes. Then the company has checked which producers that make residential multi-story buildings in volume. According to the respondent, this is the market which has had some growth. The company also has looked at potential partners who have volume factories. Bo Klok is such an example where the business idea is that they should be able to build apartment buildings regardless of what type of economy that occurs. Hence, the concept will last in an economic recession as well as in a boom. Älö Trä Vimmerby tries to process these volume producers so that they will be involved and deliver components to that type of actors. Most often, this type of actor builds in wood, and then it is the shift from laying up a concrete floor or a concrete house, to build in wooden house volumes instead. The respondent usually explains it like stacking shoe boxes on top of each other, but in wood. This is where the market opportunity of the company takes place in comparison with that type of segment (Gustafsson, 2020).

According to Lindberg (2020), Spacem2 tries to place its activities as early in the process as possible, which leads to simplifications later. The company works through a platform where it can develop continuous improvements, as making it a standardized process. The respondent means that four strategies are important when building a long term company and these must be applied in all stages and decisions that are made. Firstly, the company is to work with modules at the forefront architecturally, technically and environmentally. The company needs to have a standard that enables flexibility adapted to the customer. It must be order in all stages that constantly is improved, as well as having long term sales and secured placement in the factory. The aim should be to double the turnover of the company within five years. This applies to building structures, routines and the whole company, investing upwards and so on. The approach must be a very clear vision, a strategic plan and then all the time work in that direction (Lindberg, 2020).

Sizes Works rather cooperate with a few larger buyers (customers) than working with many small ones, according to Andersson (2020). This is because the company otherwise has to teach them the industrial process from the beginning every time. The respondent believes that the factory today will be able to produce somewhere around 2500 apartments per year. The company is not eager to take larger market shares in Sweden where somewhere between 40,000 to 60,000 apartments per year are built. If the company becomes too big, it is suddenly exposed to cycles, which the respondent is not a bit interested in as a factory manager. Instead the respondent wants a flat production all the time with clear growth all the time, but the company

absolutely does not want a slowdown. Because the offer is so attractive with a low price and quick building. It is also a quality product that is sustainable, so the company will always be very high in the list when customers choose a contractor. The next aim, after achieving 10,000 apartments per year, will be new markets abroad, such as primarily the Benelux and the UK depending on how the country manages the aftermath of Brexit (Andersson, 2020).

Relevant quotes of the respondents related to market transition are also presented in Table 8.

Table 8. Quotes of each respondent related to market transition

SME	Quotes
IsoTimber, Östling (2020)	"At the same time, resources and finances are needed for a market transition. With this in place, we will not only have Sweden and Norway as markets. On the other hand, we have also applied for patents in Canada, Japan and Europe. Therefore, we do not see any limitations to the Scandinavian market alone."
Nock Massiva Trähus, Visell (2020)	"You are afraid of start-ups and companies that do not have a large turnover backwards, and so on. There will again be obstacles like this to enter a market. You have to prove yourself first, so it is like a little walk in the desert to get up among the well-established."
Älö Trä Vimmerby, Gustafsson (2020)	"Then we worked on looking at which producers there are for apartment buildings that produce in volume. This is the market in which there has been some growth, when it comes to apartment buildings."
Spacem2 For smart living, Lindberg (2020)	"Many wood builders only want to use wood. There are a little too many idealists in it. You have to look at the economy and the market and dare to do other things."
Sizes Works, Andersson (2020)	"The second part, market presence, is a bit difficult when companies are going to build a market brand. It's more subtle. It is just to struggle, struggle, struggle and push us where we're supposed to be. After the goal of 10,000 volumes are achieved, as I started by saying, there will be new markets, that is, abroad where today we look at the Benelux, perhaps first and foremost, and the UK, depending on how they get through the aftermath of Brexit."

All of the respondents give examples of situations where possibilities and challenges for market transition can be distinguished. The usages vary between proactive efforts on present markets and efforts to enter new markets.

5.2 Partnerships, research and development

This subchapter is related to research question two which concerns which ways diffusion of knowledge concerning wood are possible for SMEs related to R&D via external actors. The identified partnerships and links to R&D of each SME, are presented in Table 9.

Table 9. Identified Partnerships, research and development on different levels

SME	Regional level	National/international level
IsoTimber, Östling (2020)	- Academia - Consults	- European project - HEIs - Close supplier relations
Nock Massiva Trähus, Visell (2020)	- Turnkey contractor on site. - Associations - Consults	- Turnkey contractor on site. - Associations
Älö Trä Vimmerby, Gustafsson (2020)	- Local subcontractors - Networks	- Academia - Research institute
Spacem2 For smart living, Lindberg (2020)	- Close collaborations - Consults	- Internal research and development
Sizes Works, Andersson (2020)	- Consults	- Research institute - Hands-on R&D

The content in Table 9 is further explained in the text below.

According to Östling, IsoTimber focuses on having good relations with several suppliers to enable fast delivery times. However, it is not the local market which is important but rather actors at a national level such as Stora Enso and Martinsons. The company has recently in partnership with PEAB, entered a construction project of an elderly home in Hudiksvall. While PEAB assembles the entire building and holds the construction contract, IsoTimber delivers the complete wooden frame walls to the construction site. The company has also managed to establish product tests via the higher research institute RISE[7], which is the main research link of the company. The actor is the gateway when it comes to IsoTimber's work within the European project *InFutUReWood*. When it comes to bio-glue, the company has a contact with a professor at RISE's office in Stockholm. Then there is a project at Chalmers industriteknik where the company is part of a small project regarding the need of biobased paint and glue. RISE also had a short partnership with Luleå University of Technology on costs and life cycle analysis. The company has done sound tests with an acoustic workshop, but a consulting service has been purchased. Within *InFutUReWood*, the company wants to start a test project regarding the use of demolition timber, i.e. recycled timber, in the building blocks. Here a good partner would be the building ecology department of Mittuniversitetet. The company has also had about 4-5 students working with IsoTimber, diploma-workers and internships (Östling, 2020).

Nock Massiva Trähus does not have a large on-site organization, which is the reason it is actively looking for collaborations with large construction companies which can take over the site. Visell (2020) has been a turnkey contractor on projects, but it is more difficult if the projects are huge or far away. Therefore, discussions have started with PEAB, Veidekke and other, small local companies, to find partners who can take the turnkey contract on site. Such collaborators are important to find, according to the respondent. The company works with Acouwood in Lund, which is a well-qualified sound acoustician. They have found fire consults who are focused on wood, especially solid wood. The company is also a member of various regional and national associations, such as the wood and furniture companies. Other important associations are for instance Swedish Office for Wood Construction and *Trästad*, which works with wood construction research and development. Because of the memberships, they, among other things, get both mails and access to meetings. According to the company, it is clear that they must share knowledge to enhance wood construction development but it needs to be mutual benefits. Though the most important thing with these memberships is to find new customers (Visell, 2020).

According to Gustafsson (2020), Älö Trä Vimmerby works with local subcontractors, such as sawmills and other small component manufacturers. The local players become important, for instance someone who manufactures raw pontoon hatches or trusses, and then the company combines this into a storage or an attic solution. Earlier, it has been a tradition at Älö Trä to do everything themselves, according to the respondent. This has meant that the companies also must be able to make windows, doors, walls, and so on. But while the large house factories are good at designing and producing the house, Älö Trä Vimmerby delivers the components. This makes the local suppliers more important. The company also works with Linnéuniversitet which upholds scientific contact. This further also connects the company with RISE. The company also receives various invitations, such as to Smart Housing Småland, which has a function to take care of new technology, thoughts and ideas. It is like a network between wooden house companies (Gustafsson, 2020).

[7] Research Institutes of Sweden (RISE) is a Swedish state-owned research institute, collaborating with universities, industry and the public sector. The aim of the organization is further to work for sustainable growth in Sweden by strengthening the business community's competitiveness and renewal and contributing to an innovative development of society.

According to Lindberg (2020), Spacem2 tries to work with selected actors. Right now, they are also trying to find a good collaboration with an architect and consults. The result is that the company and the partners get to know each other very well and the possibility to refine the processes of Spacem2. The company also works with a special drawing program in 3D, which produces finished BIM models. The goal is to have the consults to draw in this BIM system, called Vertex, so that all of them can work within the same model. This means that the company get ready-made quantities, etc. out of the system, so it saves a lot of lead times, according to the respondent. Because Spacem2 still is a relatively new company, it has no ready strategy of how to get involved in different types of forums. On the other hand, the respondent himself has earlier worked with colleges, degree projects and so on. Even if it is viewed as important, the company has not yet been involved with any university. But it will soon come as a natural part here, according to the respondent. Right now, it is mainly internal research and development together with their own consults. The whole strategy is to work innovatively, so it also will be a way to recruit new people (Lindberg, 2020).

Andersson (2020) means that they always are dependent in one way or another on external parties, such as RISE, with tests and verifications. The company has found a few actors that the respondent feels understand the matter and wants to see the larger picture. There are a huge number of choices they have to make within the platform of the company that are not natural if you are supposed to build a house at the lowest cost. Cross-laminated timber (CLT), i.e. the wooden frame, is such a material. The company also has consults in sound, fire, design, and installations. In that aspect, it is more application than research and development. During the same time, the company tries to absorb as much as possible when it comes to good solutions to the questions of the industry. The company argues that the manufacturing industry has already made this journey, so it is not necessary to invent the wheel again, but to adapt and apply it to a new product. However, the application becomes narrow and slow concerning research and development, according to the respondent. The company wants to see the results pretty quickly. The respondent guesses that today, the company and the whole industry is probably just scratching the surface. It is not always necessary to go for the optimal solution, if it now exists at all. It is much more hands-on research and development (Andersson, 2020).

Relevant quotes of the respondents related to market transition are also presented in Table 10.

Table 10. Quotes of each respondent related to partnerships, research and development

SME	Quotes
IsoTimber, Östling (2020)	"in short, RISE is the main player for us regarding R&D. With them we also carry out tests, for example fire tests. With the test project that I mentioned earlier regarding the use of demolition timber in our building blocks, I want to propose this to the building ecology department of Mittuniversitetet."
Nock Massiva Trähus, Visell (2020)	"It is probably mainly through these different associations. We are members of the wood and furniture companies also where we have collective agreements through them. Then there is something called Träbyggnadskansliet. There are a number of associations like this, for example Trästad, which work for wood construction to be developed and so on."
Älö Trä Vimmerby, Gustafsson (2020)	"We work with a guy via Linnéuniversitetet where he helps with contact between companies and academia. So if it is something we need to be aware of, he connects us to RISE."
Spacem2 For smart living, Lindberg (2020)	"It is an important piece, but we have not come so far yet that we have started to get involved with universities for example, but it will come as a natural part here quite soon. Right now, it is mainly internal research and development together with our consultants."

Sizes Works, Andersson (2020)	"We are always dependent in one way or another on external parties. RISE, for example, which tests and verifies. We have found a few actors that we feel understands the issues and want to see the bigger picture because it is necessary to do so."

All of the respondents explain how their interaction with different actors on regional, national, and international level work. Actors from academia, research institutes, and associations are perceived as relatively common partners for the companies.

5.3 Market competitiveness of the SMEs

This subchapter is related to research question three, which concerns how SMEs within industrial WMC can achieve market growth. The identified strengths and weaknesses that affect the competitiveness of each SME, is presented in Table 11.

Table 11. Market strengths and weaknesses of the SMEs

SME	Strengths	Weaknesses
IsoTimber, Östling (2020)	- Short chains of command - Easier to be creative	- Limited economic resources - Uncertainty
Nock Massiva Trähus, Visell (2020)	- Fast moving - Customer-adjustable - Flexible	- Lack of payment plans along the way - Expensive certifications - Uncertainty toward start-ups
Älö Trä Vimmerby, Gustafsson (2020)	- Very adjustable for innovation - Quick decision making	- Dependent on partners - Economic resources
Spacem2 For smart living, Lindberg (2020)	- Flexible and adjustable production - Co-value to customers	- Small player - Capital intensive industry
Sizes Works, Andersson (2020)	- Process organisation - More agile	- Uncertainty - Lack of strength as a minor player

The content in Table 11 is further explained in the text below.

Unlike larger enterprises, beneficial attributes such as short chains of command and employees who are able to be more creative in the activities of the company, could be useful factors for IsoTimber to be competitive and innovative in the construction market. By possessing a larger understanding for the routines and processes of the company, it is easier for IsoTimber to optimize these. However, the major market barrier to projects which generates uncertainty among the customers, is perceived as the access to economic resources. The uncertainty of the customers especially emerges when it comes to larger projects. The company also has identified some more third-party tests which it would benefit from but again, economical resources are a constraint for the SME. Important matters for all companies in the construction business to focus on, are to make customers feel safe regarding questions of acoustics, fire safety, moisture, etc in wooden buildings, since low knowledge of these aspects is an obstacle on the market (Östling, 2020).

The identified advantage of Nock Massiva Trähus is to be fast-moving and able to work customized, according to Visell (2020). By listening to its customers and build according to what they desire, the company also becomes very flexible. The downside is the need for payment plans where the company gets paid along the way. Therefore, it is impossible to take on larger projects without having a payment plan. End-consumers sometimes also tend to be afraid of start-ups and companies that do not have a large turnover backwards. This may result in new obstacles to enter the market. Another new trend which has been detected by the company is various requirements for certifications, such as environmental certification. This is

problematic due to the lack of resources, such as new employees, that only need to focus on certifications (Visell, 2020).

The disadvantage Gustafsson (2020) identifies is the very large expansion towards Bo Klok, which makes Älö Trä Vimmerby vulnerable if the business of this actor went bankrupt. At the same time, the business of the company is very adjustable to find production opportunities for completely new products, due to no fixed product of their own. As a component- and subcontractor, this means that Älö Trä Vimmerby can be flexible and find new solutions. However, at the same time it can also be a problem for the economy as there are many different types of projects. Therefore, the company wants to have a partial resilience in the projects it works with. Due to just having two members in the management group, decisions can be made quickly. The respondent means that there are no administrative or organizational obstacles for them to implement a rapid shift in any way. However, it is vital to have substantiated facts whether the company should join a project or not (Gustafsson, 2020).

Lindberg (2020) perceives its big advantage is being much faster and more flexible in how they can work. For example, customers think that the openness and flexibility in the thinking of the company can offer co-value that larger players cannot offer. The company then finds it easier to adapt the production. However, the identified major disadvantage is that a SME becomes a small player, and it is quite capital-intensive to build a type of factory-made production. The respondent thinks that if a SME is supposed to create a brand in industrial wooden house construction, it cannot build this on its own so it will become an economic issue for the company. There is also room for many SMEs to gain increased market shares, according to the respondent. For example, actors in industrial wood construction do not need to take market shares from each other, but to take market shares from the total construction sector. Therefore, they should not keep on tearing at each other, but instead work together. It is site-built and traditional construction that needs to be reduced (Lindberg, 2020).

Andersson (2020) identifies mostly beneficial aspects of being a SME. First of all, risk is a decisive factor. This further means that quite a few larger companies actually would step into this business due to already functional working models, which these companies usually have. Today, they make money and are very reluctant to change their current business. This makes companies such as Sizes much more agile than the larger ones. Even if a larger company did decide not to turn the entire production around, it would require a lot of reports, investigations, and preparatory work. During the two years that Sizes have actually built the factory and produced almost 300 apartments, a larger company would instead devote itself to investigating, according to the respondent. So that once a decision is made five years later, the investigations are well done, but the market opportunity is already gone. There are boards of these large companies which have an enormous responsibility for many employees and so on. On the other hand, the respondent notices a disadvantage in SMEs, which is uncertainty. In the capacity of being a minor player, you are not as strong as larger firms (Andersson, 2020).

Relevant quotes of the respondents related to strengths and weaknesses of the SMEs, are also presented in Table 12.

Table 12. Quotes of each respondent related to strengths and weaknesses

SME	Quotes
IsoTImber, Östling (2020)	"The employees therefore have fairly broad roles, which also means that they can be involved in different ways in many different aspects, widening their knowledge. This also gives us very short decision paths. I sit both as chairman of the board and head of sustainability, which is also a very important part of how clear it is for the board and for the company with sustainability issues. As a small company with a small turnover, customers are nervous about whether we will be able to deliver or whether we will go bankrupt during delivery, this is of concern for larger projects. We do not have the resources to pay a bank guarantee or the like that may be required."
Nock Massiva Trähus, Visell (2020)	"We like to listen to customers and build according to what they want, so we can also be very flexible. The advantages are that we are fast-moving and can work customized and so on. If you look at disadvantages for the end customer or that may mean that companies do not choose us, it is that you are afraid of start-ups and companies that do not have a large turnover backwards. Another downside is that we need payment plans where we get paid a little along the way."
Älö Trä Vimmerby, Gustafsson (2020)	"At the same time, we have very easy to adjust to find production opportunities for completely new products, so we do not have a fixed own product that we are stuck in, so to speak. For us, it goes fast with short decision paths. We are just two in the management group which enables us make decisions quickly. The disadvantage is that we have a very large expansion towards Bo Klok, which makes us vulnerable if their business were to be closed down. We can be flexible and find new solutions, but at the same time as it can also be a problem for the economy when you have many different types of projects."
Spacem2 For smart living, Lindberg (2020)	"For example, customers think that we are open and flexible in our thinking and can do other things than a larger player can offer. The big advantage is that we become much faster and more flexible in how we can work. The big disadvantage is that you become a small player and it is quite capital-intensive to build a type of factory-made production."
Sizes Works, Andersson (2020)	"When you come and build it from scratch, then you risk a little money, but it is not the same things in the pot. You have much more room for manoeuvre in such a position. I do not think any of the major builders will be able to handle this. I tried to push this concept in larger organizations before we decided to pull it off ourselves. There, first and foremost, you see risk in first, second, and third place, and then you start to think about whether there is actually a possibility first in fourth place. This makes us much more agile than the big companies. On the other hand, it is big business, so what is at the expense of small and medium-sized companies are uncertainties. By definition, you are not as strong as a major player. That is how it is. For us, narrow-minded partners may result in having to rebuild the entire production line, and the pace in the factory is slowed down by 20 minutes per station. There is no project in the whole world that can trump it in money. It's too expensive, quite simply."

Compared to larger companies, the respondents identify similar strengths and weaknesses that may affect the market competitiveness of the own company and other SMEs.

5.4 Future goals and sustainable development

This subchapter is related to all the three research questions, which presents identified company goals and the desirable industry future of each SME. These are presented in Table 13.

Table 13. Company goals and desirable industry future of the SMEs

SME	**Personal future goals**	**Desirable industry future**
IsoTimber, Östling (2020)	- Academic partnerships - Local projects - Reference buildings	- Able to do necessary tests - Increased focus on life-cycles
Nock Massiva Trähus, Visell (2020)	- Expand knowledge about the organisation. - All employees in-house - Local partnerships	- Learning by doing - Partners on all levels
Älö Trä Vimmerby, Gustafsson (2020)	- Flexible - More competence	- Benchmarking - Networking
Spacem2 For smart living, Lindberg (2020)	- Time and cost savings - Combination of materials	- National industrial collaboration - Practically before idealistic
Sizes Works, Andersson (2020)	- Long term relationships - Don't get stuck - Higher degree of vertical integration	- Reduce lack of credibility - Business as usual in the industry - More customer-oriented SMEs

The content in Table 13 is further explained in the text below.

Östling (2020) thinks the main thing is having the resources or opportunities to do the previously mentioned third-party tests in some way and obtain an ETA. Customers should feel well informed about technical aspects of the product and rely on a standardised quality assurance in the production. Through similar partnerships with turnkey contractors, such as the one with PEAB, it is possible to show the performance that is needed and get large reference projects to show. For example, fast assembly is an important performance aspect that brings an economic advantage for the customer. The respondent also thinks it will be more common to focus on environmental product declarations, EPDs, in the future. It may be a certification issue about which certification that will become the dominant standards that companies must follow and base their decisions on. IsoTimber will focus on the aspect of reassembly. It is important to stand out and not to be submerged in all sustainability information flourishing on the market. Today, it is common knowledge that wood is good because it binds carbon. However, the respondent says it is necessary to talk about the lifespan of the material. IsoTimber will in that context focus to show and talk about the good abilities of their product. By extending the life cycle, it also means that the forest has time to grow back during the time this building stand or this material is used. Also, in this *In Future Wood*-project, IsoTimber wants to develop an indication assessment system or checklist, where they can assess recyclability of the material in a building, i.e. how easy it is to recycle (reuse) a certain product. Regarding local collaborations and projects, IsoTimber would like to be part of a recently developed project called Jamtli Living University, which concept is an ecovillage with the purpose to test sustainability aspects in a wide way. The residents will be involved about gardening outside and social work internally in this residential area. The company would like to deliver walls, test energy saving and, for instance moisture transport in the wall and the concrete details. Plockhugget is another actor IsoTimber wants to work with. It is a company that has been established to reduce forest clear-cutting operations. The aim is not to cut down everything, but to make it into a continuity forestry. The respondent believes that this can benefit biodiversity and also help in these stand-alone storms, which will occur more and more frequently, given the climate change. However, the company has not yet had time to establish a supplier of clear-cut timber, but this is an area that they would like to achieve. Small local forest owners could then deliver timber to the local saw mill, which in turn delivers the wood to IsoTimber (Östling, 2020).

Visell (2020) believes that in the future learning-by-doing will be more common in the construction industry. Nock Massiva Trähus is already building good houses and they have no problems with aspects, such as moisture, fire, noise, etc. But everything can be improved, and there is a rapid development in this industry that will change it in a few years from now. The respondent argues that they cannot only sit at the drawing board with this, then nothing will ever be done. The respondent says that the company also needs architects who understand how Nock Massiva Trähus is thinking. In the best future, the company has all these employees in-house. It will be vital to find partnerships at all levels. Both small and large turnkey contractors who can help the company get both procurement with municipal companies, but also to finish the projects on site. The respondent also needs suppliers who come up with new ideas about how the company can improve its business, *e.g.* how to reduce floor-frames/tier of logs. The company further only purchases certified wood as raw material. Local construction companies are also perceived as vital actors for the company. Nock Massiva Trähus tries to influence these, because they are considered as a suitable market for the company. They also have made a lot of contacts with municipalities and local municipal companies. The company hope to influence them to engage in building partnerships both in terms of proximity, environmental principle, and cost efficiency. It is also of importance that local municipalities and authorities make procurements and set requirements that promote wood construction and the environment. According to the respondent, this is necessary due to the pressure from the large concrete industry. But there are good things otherwise too. The respondent, who earlier has worked with sales, knows that when a company has many different customers, as a supplier of screws may have, they also have a large R&D department that works with other customers. These may in return also come to Nock Massiva Trähus with developed solutions. But it may not be so good having everything internally, the respondent admits (Visell, 2020).

Gustafsson (2020) thinks it will be important for SMEs to be flexible, but also to get access and bring in more competence. Älö Trä Vimmerby needs to bring in additional designers, engineers, and this can be a problematic aspect due to the actual geographic location of the company. The respondent says it is not so interesting for young academics, i.e. newly educated people who rather would work in big cities instead of places like Vimmerby. That is why competence development is a challenge, and an important matter for the company and other small companies, because otherwise they will not keep up. At the same time, it is necessary to develop the current staff that does not have such a necessary school education but also to get in new and fresh skills. Beside competence, the company also must find new solutions. It wants to be visible on the market, on the construction sites and in the networks. In the future networks will be important to deal with any worries or problems the company got stuck with, and that can be turned into something good by collaboration. It is probably quite important that companies work with benchmarking and networking, both with suppliers, customers and others, so that they get as much input as possible about what is happening in the market. It is vital not to sit in its own little bubble and become too introvert. Therefore, companies need to have their contacts out there and work on a broad scale (Gustafsson, 2020).

The time frame of the factory processes and the work done out on site will both be shortened in Spacem2 by processing procedures with the aim to achieve cost savings. Lindberg (2020) means that industrial wood SMEs have an enormous traction today via the media and public opinion, and wooden house construction is well talked about everywhere. The respondent further thinks that is a result of the hard work of the industry. If you are going to build a brand for industrial wooden house construction, an individual company cannot build this on its own. Therefore, Spacem2 perceives it as desirable and highly important that a larger national industrial collaboration is initiated. This would involve professional trade associations which

must push the issues, such as TMF, as well as committed members. The aim must further be not to snatch market shares from each other, but to reduce traditional on-site construction by supporting each other. The respondent points out another important parameter that the choice of construction material should not exclusively be divided in wood versus steel, or concrete. If one is to succeed in building such houses that people are looking for, such as tall houses, perhaps wood could be a limitation. There are various idealists due to the fact that many wood builders focus on wood exclusively. It is important to observe the economy and the market, and for instance dare to do other things. Spacem2 is now planning to build a house where the stairwell will be made of concrete, and some components will be wood and steel in the load-bearing construction. A combination of the materials is vital because all materials have different properties and different benefits. It is not possible to be as strict as someone desires. According to the respondent, there is still much development in the industry to be achieved. The next step is to make wooden multi-story buildings even smarter, more efficient and more economical. By using wood and modules in the right way, it is also possible to build fast. It can result in extremely short construction times compared to other materials, and it arrives in perfect condition from a factory (Lindberg, 2020).

Andersson (2020) does not think that there are any particular extra actions industrial wood SMEs should take for increasing their market shares, but to continue their current business approach. Sizes Works and other similar SMEs have no problems on the market today, according to the respondent. They need to continue to do what they are doing today for a longer time and more. The possible lack of credibility will likely then be removed by repeating this process as the company has done for three years. When the market becomes interested, it will be bigger than the companies will be able to handle, both on the sales side and on the production side. The worst nightmare of the respondent is that Sizes Works will go through this initial process, land on a platform, and then continue to stay there for 20 years. All this just to be totally overrun in 10, 15 or 20 years by a new player who has invented something even sharper than Sizes Works. What the company needs to do is to keep pushing themselves forward all the time. The respondent also hopes that more people will be customers-oriented than they are today. There are far too many people who just have an idea of how to make things, and then they hope they will find a customer who wants to buy it. *I Am Home* buy contracts as a developer to get the houses built. The respondent says that is how Sizes started. Costs are important and construction companies do not want excessive cost developments, nor want to be out with money for a longer time or that the transactions become complicated. The core business of Sizes Works is completely different from the entrepreneur's, but the usual approach is unfortunately very strict. Then it will be difficult to work with the market, according to the respondent. Hence Sizes Works also want a much greater degree of vertical integration so that it is possible to develop the business together with suppliers. It is important to talk about these kinds of issues, which require a long-term perspective of collaboration. It must benefit both parties (Andersson, 2020).

Sustainability is also an important factor for each of the respondents. Relevant quotes of the respondents related to sustainable development are also presented in Table 14.

Table 14. Quotes of each respondent related to sustainable development

SME	Quotes
IsoTimber, Östling (2020)	"Plockhugget is a company we want to work with, providing timber. The aim of the company is to promote continuity forestry and reduce large clear-felled areas. We understand that this could benefit biodiversity and the forests to withstand storms that will occur more and more frequently, given the climate change."
Nock Massiva Trähus, Visell (2020)	"Then it is the case that we buy from those who have certified their wood, and that means a lot of things that they then promise, for example that they plant three new trees for each tree that they take down. Otherwise, you cannot claim that you improve the environment when you take down a tree, which absorbs carbon dioxide. Now you take down a tree and store that carbon dioxide and then you plant new trees that pick up new carbon dioxide."
Älö Trä Vimmerby, Gustafsson (2020)	"When you make the material shift from concrete to wood, you contribute to sustainable development, and that is where we can be involved and contribute. When you work with wood, you can for example bind carbon dioxide. Socially, we retain jobs and also the opportunity for this type of industry in the local community. If we were not here, these jobs would disappear. There is therefore of local economic interest working with wood in the region in which we are located."
Spacem2 For smart living, Lindberg (2020)	"It is the processes that make it possible to control the use of resources and the environment which becomes a natural consequence of the whole thing. That is a very important parameter. Wood is a very materiel that, from a carbon dioxide perspective."
Sizes Works, Andersson (2020)	"There will be significantly fewer transports with industrial production than with traditional construction. Instead of small deliveries to a lot of different projects, here you only have one transport to the factory, and one transport to the construction site. Here you get a huge opportunity to bring in labour that does not come from four years of apprenticeship in a construction sector. In the Oskarshamn model you take new arrivals and put them in training for three to six months in fundamentally different points and then they have a final education with us for one to two months. Then they do their job fantastically well. So there are shortcuts to work that way and that do not require long educations. It is a pretty strong social aspect, I think."

All respondents give examples of the sustainable issues their companies are involved in or want to get involved in the future. Mainly, it concerns environmental aspects related to working with wood as a material and reduced GHG-emissions from the industry. It also concerns social matters such as increased job and education opportunities, and the development of small regions and rural areas. In the following chapter, these empirical results will be analysed with a discourse analysis. The analysis of the data will further be supported and explained through the theoretical framework of this project.

6 Analysis

This chapter aims to analyse the empirical data with the support from the theoretical framework in Chapter 2. A discourse analysis, according to the four different steps, will be proceeded to identify relevant themes of discourse. This will further be explained via the theoretical framework for market development.

6.1 A framework for market development

The discourse analysis of this project is supported by the theoretical framework of market development (Figure 6).

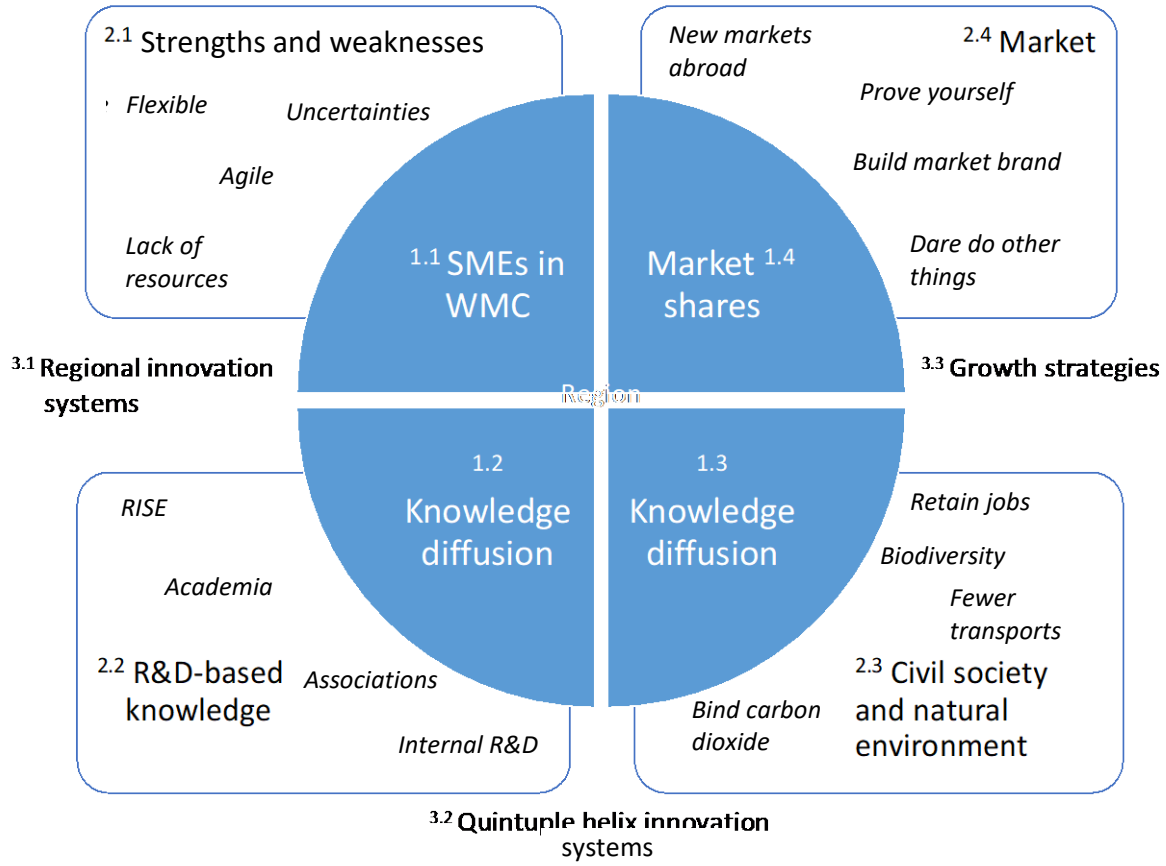

Figure 6. Using the conceptual framework for analysis of market development.

The result of the interviews above with the respondents have been linked to each of the outer quadrants in Figure 6 (2.1, 2.2, 2.3, and 2.4). The circular process of the framework needs to be managed continuously by the SMEs to achieve knowledge diffusion and increase the market shares of industrial WMC (1.4). The first part of knowledge diffusion (1.2), *e.g.* linked to production processes and collaboration, will be gained via the access to research and development via different regional and external channels (2.2). This process will be supported by the use of RISs (3.1). The second part of knowledge diffusion (1.3) will be gained via the Quintuple helix systems (3.2) where different considerations about civil society and enhancement of the natural environment (2.3) are made. Together, these varieties of knowledge diffusions can support growth strategies (3.3) of the SMEs to achieve market growth (2.4). In accordance to the identified themes of discourse, this will further be connected and explained

by the theories that constitute the framework of market development, in the following subchapter 6.2.

6.2 Identified discourse analysis themes

The identified themes from the literature review and discourse analysis of the interviews are summarized in accordance to specific areas, related to four sub-areas of market development (Table 11).

Table 15. Identified themes within related areas of market development

Related sub-area	**Identified themes**
Market competitiveness	Flexibility, quickness, uncertainty, economic boundaries
Market transition	Opportunities, difficulties
Research and development	Regional, external
Sustainability	Environmental, social

Related to market competitiveness, all respondents indicated their market strengths within themes of flexibility and quickness. When it comes to market weaknesses, all respondents directly indicated themes of economic boundaries, while four of them also indicated themes of uncertainty. Related to market transition, all respondents indicated themes of various opportunities and difficulties within the sub-area. Related to R&D, four of the respondents directly indicated themes of external sources, while three of them directly indicated to regional sources. Related to sustainability, all the respondents directly indicated themes of environmental sustainability, while two of them directly indicated themes of social sustainability.

The particular use of words and phrases that each respondent chose to construct these themes with, were identified from the empirical data. Even though the phrases composed the main explanation, specific words were also noted as particularly describing.

6.3 Identified commonalities from the use of language in relation to the construction of each theme.

Next step included the identification of commonalities from the language use of the respondents. Similarities and differences in how the respondents constructed the actual themes, are further explained in the texts below.

6.3.1 Language to construct regional and external R&D

Related to the concept of market development, the respondents used words and phrases to describe and persuade the listener in terms of R&D. Four of the SMEs (IsoTimber, Nock Massiva Trähus, and Sizes Works) were described by the respondents to be linked with external channels to gain access to R&D. Words such as “we are always dependent” and “the main player for us” described the relational proximity to these channels. Lindberg (2020) admits its importance, but also refers to Spacem2 as a relatively new company in the early stages of its strategy creating. This importance of the issue was demonstrated with words as desirable and that future interactions with external partners in R&D will “come as a natural part”. Three of the respondents (Östling, 2020; Gustafsson, 2020; Lindberg, 2020) indicated to be linked to regional R&D, two related to regional universities (Östling, 2020; Gustafsson, 2020) and one related to regional consults (Lindberg, 2020).

6.3.2 Regional innovation systems

Various parts of the usages of the respondents also indicate knowledge transfers from outside actors, such as other firms and different types of institutions. A vital objective in RISs would be that its actors continue to strengthen the regional infrastructure (Mytelka & Farinelli, 2000). Two of the respondents (Visell 2020; Andersson, 2020) did not directly mention access to regional sources of R&D. However, many small regions are not able to have research institutes or local research universities. When this is the case, it has a crucial aspect, especially for SMEs, to get knowledge and innovation through external channels to R&D, on both national and international level (Asheim and Isaksen, 2002; Mytelka & Farinelli, 2000). In innovative regional clusters, firms are likely to have access to contract or research organizations (Cooke *et al.*, 1997, 484). All SMEs in this project are members in TMF, which drive important issues within the industry. Nock Massiva Trähus is involved in various regional and national associations, such as Swedish Office for Wood Construction and Trästad, which focus on wood construction R&D (Visell, 2020). Universities are also mentioned to be common knowledge providers. Except for these institutions, also HEIs are vital for the RISs. Three of the SMEs (IsoTimber, Älö Trä Vimmerby, and Sizes Works) are involved with a national research institute, RISE, which enables the companies to establish tests and verifications. Through this external actor, IsoTimber has access to the European project *InFutUReWood*, which enables further product development of the company (Östling, 2020). Even though Sizes Works is involved with external HEIs, there is much more hands-on research and development within the company, according to Andersson (2020). Spacem2 is for the moment mainly involved with internal research and development with its consults. However, Lindberg (2020) perceives it as desirable and highly important that a larger national industrial collaboration is initiated together with professional trade associations, such as TMF.

6.3.3 Language to construct environmental and social sustainability

All respondents directly addressed the theme of environmental sustainability. Beneficial aspects were illustrated with words such as “benefit biodiversity”, “plant new trees”, “bind carbon dioxide”, “control the use of resources and environment”, and “fewer transports”. Two of the respondents (Gustafsson, 2020; Andersson, 2020) also directly addressed the theme of social sustainability. Both the respondents used similar words such as “retain jobs” and “opportunity to bring in labour”. Gustafsson (2020) also mentions other benefits, such as “opportunities for this type of industry”. On the other hand, Andersson (2020) demonstrated the full process of a regional initiative the company is involved in to educate and generate job opportunities for exposed groups, such as immigrants. This type of involved individuals was also described in very positive terms, such as “doing their job fantastically well”.

6.3.4 Quintuple helix innovation systems

The theme of social and especially environmental sustainability as well as the corporate efforts in interaction with other actors, are recurring topics of the respondents. This could eventually be explained through the extension of the quintuple helix that include the two subsystems of civil society and the natural environment. The natural environment is considered a central element for the production of knowledge and innovation because it constitutes an irreplaceable source for the survival of man. The realization of new green technologies and innovative processes in the direction of a sustainable development becomes fundamental to promote long term innovative strategies. Östling (2020) highlighted examples of desirable future partners which would enhance the continuity of forests. The result would likely benefit biodiversity and counteract climate change. Visell (2020) referred to certified wood which in turn would result in new trees being planted. These would then absorb a higher amount of carbon dioxide

compared to those cut down. Gustafsson (2020), Lindberg (2020) and Andersson (2020) all indicate, but in slightly different ways, how work with wood as construction material, and fewer transports contribute to positive sustainable aspects for the natural environment, such as reduced levels of carbon dioxide in the atmosphere. This could be derived to Provenzo *et al.* (2016) in how knowledge and innovation in the direction of a sustainable and social economy get affected by the protection of the environment and biodiversity. Social concerns related to job opportunities in which Gustafsson (2020) and Andersson (2020) addressed, indicate proactive efforts to promote local and rural communities in the actual regions. This could be signs of an adoption of policies with a place-based approach (Barca, 2009) for rural development. This further takes the real problems of territories into consideration, such as the physical and productive depopulation of inland areas (Provenzano *et al*., 2016). According to the quintuple helix, all actors are perceived as responsible for the formulation of strategies for local development (*Ibid.*). Each of the respondents gives indications of managing current or future strategies for local development in collaboration with its industry, mainly on a national but also on a regional basis. These can all be signs of reassessments of the local natural resources combining the new opportunities provided by access to information technologies, which can provide trajectories for sustainable growth, especially in the peripheral areas (*Ibid.*).

6.3.5 Language to construct flexibility, quickness, uncertainty, and economic boundaries

Related to the concept of market development, the respondents used words and phrases to describe and persuade the listener in terms of market competitiveness. This is further explained for each SME respectively below.

The theme of flexibility was used by all the respondents as a crucial advantage to market competitiveness. It was expressed that every employee in the company possess “broad roles” (Östling, 2020) due to the small size of the company. This was considered as an indirect reference to the ability, and theme, of flexibility. By some of the respondents, the theme was also referred to directly, “flexible” (Visell, 2020; Lindberg, 2020). They also related it in relation to customer focus. The production of the company was also described as “very easy to adjust” (Gustafsson, 2020) due to none fixed product. Strong tendencies of flexibility are shown in the chosen key words “much more room for manoeuvre” (Andersson, 2020). This is a demonstration of what market competitiveness SMEs possesses, according to the respondent.

The theme of quickness was also used by all the respondents as an advantage to market competitiveness. It was referred to in similar demonstrations of management control by the respondents, such as companies that is characterised by “short decision paths” (Östling, 2020; Gustafsson, 2020), “fast-moving” (Visell, 2020), “much faster” (Lindberg, 2020), and “more agile” (Andersson, 2020). However, Östling especially highlights this as an important effect to better issues of sustainability in the own company. Andersson (2020) uses the word agile, which likely could refer to being able to move quickly and easily, compared to larger firms which often are more reluctant to take reform risks of their business models.

Tendencies for the theme of uncertainty were either directly or indirectly marked as a disadvantage to market competitiveness, except by Lindberg (2020). It was expressed by words such as “nervous” (Östling, 2020), “afraid” (Visell, 2020), “vulnerable” (Gustafsson, 2020), and “uncertainties” (Andersson, 2020). Both Östling and Visell highlighted similar disadvantageous effects of being a start-up SME where lack of financial resources may cause scepticism from their customers. Östling (2020) seems to associate this uncertainty especially with larger project involvement while Visell (2020) chose to talk about the absence of large

turnovers historically. Gustafsson (2020) referred to an example, such as the collaboration with Bo Klok, as a depending factor that could generate uncertainty if the business would falter. Andersson (2020) directly put uncertainties as a reality for SME in general. The respondent further points out that these lack the "strength of major players". Though Lindberg (2020) did not express any particular signs for the theme of uncertainty, some similarities with Andersson (2020) could be identified. Lindberg (2020) defined the own company as a "small player", which means that it differs from larger players. Therefore, both respondents may be referring to the same problems, but from opposite angles. This means that the usage of Lindberg (2020) indirectly could possibly be associated with an uncertainty in itself.

Economic boundaries were mentioned by all the respondents as a crucial disadvantage for market competitiveness. It was addressed and described through phrases and key words, such as "not have the resources" (Östling, 2020), "need payment plans" (Visell, 2020), "problem for the economy" (Gustafsson, 2020), "capital-intensive" (Lindberg, 2020), and "expensive" (Andersson, 2020). Östling defines the economic boundaries in terms of actual lack of resources as well as speculations about it. The respondent recognizes the negative effects of being a small company and uses the word "bankrupt" as a likely prejudgement from nervous customers when the company may be involved in larger projects. In return, this could result in an actual lack of resources for the own company. The respondent chooses to mention the non-option of "bank guarantee" as a likely consequence. Visell (2020) rather defines the negative part as "the downside" of a SME, who needs payment along the different stages of a project. This indicates economic boundaries. However, when involved in multiple projects simultaneously, Gustafsson (2020) formulates this as a factor that could cause a "problem for the economy" for the company. This could be quite similar to the perceived economic boundaries mentioned by Östling (2020), related to particular types of projects. Lindberg (2020) defines the establishment of a factory-made production with words such as "quite capital-intensive". In this matter, the respondent further describes being a small player as "the big disadvantage". This capital-intensive factory-made production may be related to the way Andersson (2020) addressed terms of economic boundaries. This respondent takes forced reforms in their production line as an example that may result in expensive costs for the company. The reason may be that some partners tend to be too narrow-minded when it comes to projects they think have a given solution that the company will approve immediately.

6.3.6 Language to construct opportunities and difficulties for market transition

Related to the concept of market development, the respondents used words and phrases to describe and persuade the listener in terms of market transition. Östling (2020) used words that explained control over different resources as a condition that could provide market transition opportunities, as well as opportunities to expand the business into new markets. In contrast, Visell (2020) rather describes the difficulties of being a small start-up company which has to prove itself to overcome market barriers. The respondent also marks the problems by a description of market obstacles as "a little walk in the desert". Gustafsson (2020) uses terms of a potential for market growth in a specific area of industrial production, such as production of volume. Lindberg (2020) uses words to describe the opportunities that may emerge by not being too narrow-minded considering wood constructions. This may have similar patterns in the way of "dare to go further" and "think broader", such as new markets, similar to Östling (2020) and Andersson (2020). Like Visell, Andersson perceives the market presence as a bit difficult where the companies continuously need striving to develop a market brand for itself. However, instead the respondent gives numerical quantities that express company aims. By the fulfilment of these, possibilities to expand business presence to new markets abroad are expected to emerge.

When control over the resources has been achieved, these opportunities can be identified as the same type of phrase-building expressed by Östling.

6.3.7 Growth strategies

In accordance to the identified themes of a discourse in market competitiveness and transition, these could be crucial factors in the development of growth strategies. This is further explained for each SME respectively below.

Östling (2020) explains that the company will continue to develop the product and other small aspects related to it, such as production adjustments. A particular focus will be on reassembly and extending the life cycle of the unique product in collaboration with research-links to external channels, such as RISE. During a product development growth strategy, a modified or new product/service is offered to an existing market. Unlike the market penetration, which also in some degree may include product development, there is a far higher level of innovation involved (Johnson *et al.*, 2008). The respondent also means that it is not just about recycling, but the reuse of the product. This could further be possible through the European project *InFutUReWood* where there is a desire to produce indication assessment systems or checklists. This could likely differentiate the company in the future, according to Östling (2020). The respondent also mentions that future business may involve new markets abroad. This could be associated with diversification where the organization must move from its existing products and markets towards undiscovered areas (Johnson *et al.*, 2008). This would mean that the company departs from a product development strategy into a diversification strategy. Unlike the other growth strategies above, this one takes place with a new product on a new market and is commonly associated with restructuring in characteristics regarded to the product and/or market of the company. It is the riskiest strategy but if it is successful, it can result in efficiency gains, stretching corporate capabilities and increasing market power (Ansoff, 1957).

Visell (2020) means that the company has two goals; the first is to fill the capacity of 500 volumes in the factory per year. The second is to expand with new facilities and reach 1000 volumes per year. It further wants to increase the company sales without restructuring the primary product strategy. This could be associated with a market penetration growth strategy (Johnson *et al.*, 2008). According to the respondent it is difficult in getting the attention of customers without showing them the factory and on-going projects. Therefore, the company has built two houses for showing, close to the factory (Visell, 2020). This strengthens the argument of market penetration due to marketing an existing product on an existing market in a different way (Johnson *et al.*, 2008).

Gustafsson (2020) means that the company wants to broaden its customer base by finding the right segments. This aim can be associated with new segments, which is one of the three distinct forms regarding to the focus phenomenon of the company, in a market development growth strategy (Johnson *et al.*, 2008). By focusing at valuating different building methods as well as producers, the company found produced multi-story buildings in volume as an attractive area due to its previous noticed market growth (Gustafsson, 2020). However, the strategy may fail if it involves traditional offers on the new market that does not fulfil critical success factors concerning the product or service of the company (Johnson *et al.*, 2008). The respondent mentions that the identified market opportunity is to deliver components to actors with innovative business concepts, such as Bo Klok with the idea to build apartment buildings regardless of the present type of economy (Gustafsson, 2020). This could involve something beyond a traditional offer toward a new market of multi-story buildings produced in volume. However, it is common that lack of necessary successful marketing competencies and vital

knowledge about specific forms that characterise the potential market. This could be problematic to the company due to competence development challenges. The respondent points out the geographic location of the company as such a challenge (*Ibid.*).

Lindberg (2020) explains that the company works via a platform where it can work with continuous improvements in a standardized process. The whole strategy is to work innovatively which will be a way to attract and recruit people to the company, according to the respondent. Unlike market penetration, which also in some degree may include product involvement, a product development growth strategy has a far higher level of innovation involved (Johnson *et al.*, 2008). Through the four strategies of the company, the production processes will be refined continuously. The aim is also to double the turnover, by investing in structure building, routines and the whole company (Lindberg, 2020). This could be related to investments in necessary requirements in a product development strategy for obtaining new strategic capabilities, such as new technologies. However, this may also include higher costs and a higher level of risk for the company (Johnson *et al*., 2008). Due to disadvantages of being a minor actor in a capital-intensive industry, this may be problematic for the company, according to the respondent (Lindberg, 2020).

When the aim of producing around 2500 apartments per year is achieved, the respondent is not eager to increase its market shares any further in Sweden (Andersson, 2020). The current approach of the company can be associated with a growth strategy of market penetration. This path could be considered as a desirable option if the market is not saturated or if it is possible in just maintaining market shares to gain growth (Johnson *et al.*, 2008). The market of industrial wooden construction can hardly be defined as saturated (Government Offices of Sweden, 2018; Swedish Office for Wood Construction, 2016), and the company seems to believe that it is possible to maintain its certain amount of market shares. It is also reluctant to become too big in this market, due to the risks of being exposed to cycles. Instead, continuous clear growth is desirable (Andersson, 2020). This further indicates that a market penetration growth strategy could be recognised because it implies less investments and a lower risk-taking for the company (Johnson *et al.*, 2008). The next step of the company is expanding its business into new markets abroad (Andersson, 2020). This may indicate the implementation of a market development growth strategy. Johnson *et al.* (2008) explains market development as a growth strategy which involves delivering the existing products of the organization into a new market. The new market of the company takes its form in new geographic areas (Andersson, 2020), which is one of the three distinct forms that characterises this growth strategy (Johnson et al., 2008). This implies a higher degree of risk than a market penetration, and it is crucial that the strategy fulfils critical success factors concerning the products or services instead of launching traditional offers on the new market (*Ibid.*).

6.3.8 Regional innovation systems

Through regional clustering, SMEs could affect their strengths and weaknesses to enhance their market competitiveness. Some formulations of the respondents indicate the use of tacit knowledge and knowledge transfers could be such factors. This type of knowledge usually constitutes skills, structure building, experience and routines which not necessarily are exclusively conscious by the owners (Leonard & Sensiper, 1998). Tacit knowledge is often relevant for innovation processes and is mainly generated through communication channels, such as employee mobility (Johansson *et al*., 2006). Through the identified abilities of flexibility and quickness, such as broad employee roles, flexible actions towards customers, and short decision paths, the SMEs could be more receptive to generate this type of knowledge.

Through RISs, it could also be possible for the SMEs to reduce negative market weaknesses, such as uncertainty. Innovative activities can be stimulated by mutual trust and collective tacit knowledge. In clusters, these components could likely be developed through relational proximity where the trust, except for reducing uncertainty, also enhances shared knowledge while collective tacit knowledge could ease the knowledge transmission (Wiig & Wood, 1995).

7 Discussion

This chapter will constitute a discussion of how the results of this project can be related to previous research. The prior aim is to address the three research questions that were formulated in the introductory chapter (Chapter 1). Except for this, practical implications and reflections of the methodology will be discussed.

The aim of this project was to address the following research questions;

- How can SMEs in WMC use regional innovation systems for creating competitive growth strategies to promote sustainable value?
- In what ways are diffusion of WMC knowledge concerning wood possible for SMEs related to research and development via external actors?
- How can SMEs in industrial WMC achieve market growth?

7.1 Competitive growth strategies of SMEs

Regarding the first research question, the targeted SMEs can create competitive growth strategies to promote sustainable WMC. Indications about a strong customer focus in the strategic considerations amongst the respondents are found. The respondents highlight the importance of well-informed customers and that flexibility towards their needs are vital.

Enabling good and close collaborations with professional actors, such as architects, are also noted as important to make them better understand the business of the SMEs. This could indicate an awareness that expectations, values, and communications of the consumers are crucial to affect their decision-making (Mark-Herbert *et al.*, 2019), and that proactive efforts must be done to steer these. This is supported by the beliefs from four of the respondents who argue that uncertainty is common perceptions by customers and end-consumers toward SMEs. Xia *et al.* (2014) also means that uncertainty is reflected in the prejudices of end-users related to wood itself as a construction material, *e.g.* fire-safety, maintenance costs etc. Mahapatra and Gustavsson (2009) argue that path dependent processes are strengthened by technological and marketing uncertainties, such as to wood as a structural component in multi-story buildings. This can further be linked to the perceived lack of understanding and knowledge of the consumers regarding structural materials (Roos *et al.*, 2010), and that their perceptions could be influenced by the understanding of construction material from professional actors (Mark-Herbert *et al.*, 2019). These acts of the SMEs could eventually contribute to reduce institutional barriers that maintain path dependency and increase the probability for radical innovations.

The results also have shown tendencies of regional clustering. In RISs, partnerships with regional and external HEIs also could function as incubators for start-up companies since they qualify and support potential entrepreneurs (Koschatzky, 2001). By the involvement in this type of interactions, SMEs would likely benefit from increasing its credibility and get access to more efficient scientific and technological solutions. Uncertainty and economic barriers related to SMEs, may then be diminished.

The results also reveal that some respondents mention goals of expanding the business of the companies to new markets. This could be associated with the forecasts of the Government Offices of Sweden (2018) about the potential of increased exports of Swedish industrial wood constructions. Due to a more urgent need for sustainable housings, the global interest has increased. The respondents also seem to give the natural environment a central position, where

various corporate efforts strive to reduce the amounts of carbon dioxide, protect biodiversity, and contribute to more circular societies. This is further in line with the concept of the quintuple helix model (Grundel & Dahlström, 2016).

One interesting aspect to consider is that one of the SMEs stressed the importance of not being too idealistic when it comes to building with wood. Even if it is considered as a construction material with both practical and sustainable benefits, it can probably also be a limitation in some occasions. Combinations which are decided by the various properties of different materials, probably need to be considered. Tall construction projects, such as multi-story buildings, need to be built with great concern for both safety and durability. Therefore, efficient strategies to promote wood could possibly be to explore and encourage combinations with other construction materials.

7.2 Diffusion of research and development via external actors

In relation to the second research question, the results indicate that the respondents have a high reliance to external actors concerning access to R&D and the diffusion of it. However, there are different ways in how the investigated SMEs address this issue. Due to the fact that small regions often are not capable to host regional R&D-actors, this aspect is necessary, according to (Asheim & Isaksen, 2002; Mytelka & Farinelli, 2000). Some of the SMEs tend to use external knowledge providers such as universities, *e.g.* Mittuniversitetet and Linnéuniversitetet, and HEIs, *e.g.* RISE.

According to Koschatzky (2001, 3), HEIs could be an option which gives access to vital R&D-competence, which in contrast to universities, provides two major functions in the region. Firstly, it manages the common knowledge base of a region as scientific and technological information, and the transfer of technological or scientific solutions. Secondly, at the same time it provides expertise knowledge while taking into account the specific needs of single actors. Some of the SMEs, who now not are fully connected to external knowledge providers, such as universities and HEIs, instead put reliance to internal R&D. There can be efforts to optimize the process routines, such as the production. However, Asheim and Isaksen (2001) argue that especially SMEs usually cannot rely on this type of knowledge exclusively, but also need to get access to universal and formal knowledge, such as R&D-competence. In the same time, all of the case-SMEs could to some extent be perceived as involved with external actors which constitute sources to information and R&D-based knowledge. Some of the different associations the SMEs are members could be defined as indirect links to R&D. All case-SMEs also use consults that, to some extent, could be counted both as external actors and links to HEIs.

7.3 Opportunities for market growth compared to large enterprises

Regarding the third and final research question, the results show a relative unity amongst the respondents about what perceived opportunities SMEs in industrial WMC have to achieve market growth. Abilities such as flexibility and quickness were considered as crucial competitive advantages of the SMEs, while disadvantages were considered to be abilities of uncertainty and economic boundaries. This is in line with Ahmadi and Helms (1997) who argue that flexibility and quickness are competitive attributes which enable SMEs to rapidly respond to shifting demands and change. Structural changeovers related to sustainable development can also be enhanced by both characteristics of flexibility and quickness. Large companies instead usually have collective decision-making while employees at lower levels perform more narrow activities.

Related to economic boundaries as a disadvantage of the SMEs, Brege *et al.* (2013) consider it as common challenges for the development of the wood construction industry. Lack of resources, such as large turnovers, is also an identified weakness that generates uncertainty related to start-ups.. Therefore, it can in some degree be connected with economic boundaries. However, large construction companies also could be considered affected by uncertainty, but in quite another way. One respondent meant that this risk is a factor that usually stops large actors to step into this industry due to their more traditional and already functional business models.

This mentioned risk can certainly be linked to uncertainty, as new investments often are associated with a higher level of risk and uncertainty. Therefore, unwillingness to change existing activities are also partly due to perceptions of increased costs and time-consuming reforms (Government Offices of Sweden, 2018). This can further be connected to competitive opportunities for industrial SMEs within WMC, where the abilities of flexibility and quickness could help in the achievement of increased market growth.

7.4 Practical implications and methodological reflection

Practical implications related to language differences, interview type, and clarification related to the chosen theory of the project, are worth some reflection. The interviews of this project were conducted in Swedish. This meant that the research, where the researcher and the interviewees both had the same non-English native language, would result in an English publication. According to van Nes *et al*. (2010), this could be a challenge due to language differences in qualitative research where loss of meaning is at risk. Qualitative research focus in studying meanings in subjective experiences. Language is used both to express meaning, but it also influences how meaning is constructed (*Ibid.)* In this situation, it is also easy to imagine other challenges which could follow with the implementation of a DA. The reason could be the fact that an interpretive DA identifies the subjective meanings which are included in the analysed texts (Heracleous, 2004). In this project precautions were taken during the translation process, such as working in the original language for as long as possible. The translation was also sent to each respondent for confirmation to reduce the loss of their meanings and to minimize negative impact on the reliability of this research.

Because of Covid-19, interviews in this project were conducted by Zoom and phone. Traditionally face-to-face interviews have been the dominant interview technique in qualitative research (Qu & Dumay, 2011; Novick, 2008). This technique allows understanding through the body language of the interviewees and cues from their physical environment, according to Gillham (2005) and Shuy (2003). However, Aranda (2020) argues videotelephony as a technique which enables picking up nonverbal cues and the building of rapport with the respondents. In that aspect, it could be considered to be as good as face-to-face interviews. According to Weller (2017), this approach is especially suitable with respondents who otherwise might not be able to participate due to distance or time. Only one of the interviews was performed via phone due to time pressure and preference of the respondent. It may have affected the result to some extent due to loss of nonverbal cues, but not likely in a decisive way. Interviews by video telephony and phone also can be preferable due to convenience, accessibility, and the use of common media (*Ibid.*). A conscious approach in this project was further to suggest those types of communication media which most people are familiar with and have access to. During the current circumstances, this choice probably became more practical and convenient both for the author and respondents.

It might be important to discuss the role of RIS as theory in this project. Concerning some broad

8 Conclusions

This final chapter presents the overall conclusions, derived from the research questions, that have emerged from this project. The chapter ends with some suggestions for future research.

The aim of this project is to identify similarities and differences in market innovation strategies for SMEs within industrial WMC. The research contributes to how Swedish representors of SMEs within industrial WMC choose to address issues related to regional collaborations, diffusion of knowledge, innovation, strategies, and sustainable development.

8.1 Contributions from this project

The main findings of the project are that SMEs in industrial WMC create competitive strategies in various ways to promote market development of the industry. This is also shown between case-SMEs which belong to the same region. Some of the investigated SMEs rely on the current markets by optimising the routines, production, business as usual and closer relationships to partners, while others seek expansion to new markets. However, path dependency still seems to be present to the disadvantage of wood as a construction material in multi-story buildings. Today, the majority of the investigated SMEs mainly tend to be involved in incremental innovation. Only one of them indicated patterns of a diversification growth strategy and being involved in more radical innovation.

Attached to each of the strategies, promotion of environmentally sustainable value can be created in different ways due to the industrial process which focus on preservation, recycling, reuse, and efficiency improvements, *e.g.* reassembly of the material, and reduced GHG-emissions, *e.g.* fewer transports. The strategies also can involve promotion of socially sustainable value by generating new job opportunities and addressing needs of vulnerable groups in the society.

The SMEs are also connected to external associations that provide information and knowledge. To access necessary R&D-competence, some SMEs have connected themselves to both regional and external universities and HEIs. Those companies who have not, intend to make such connections in the future. Until then, internal R&D is the main activity to access relevant knowledge. Hence, this confirms previous research (Asheim & Isaksen, 2002; Mytelka & Farinelli, 2000) concerning the needs of external channels to achieve access to R&D.

Compared to large companies, SMEs can possess unique opportunities that could generate competition and increased market growth. All respondents give various examples of flexible and quick abilities which can be perceived as suitable both for industrial WMC and sustainable development. Also, awareness of their weaknesses, such as economic boundaries and uncertainty, makes it possible to manage these via relational proximity in regional clustering together with other companies and knowledge providers.

8.2 Suggestions for future research

This project provides a contribution to innovation studies as well as an increased attention towards the importance and eventual competitive potential within SMEs. Through this research, unity of intellectual frameworks that are beyond disciplinary perspectives, such as the combination with regional science studies, market studies, and sustainable research, has been made.

Propositions for future research are to continue investigating how SMEs could contribute to the development of societies and nations. Through the adaption of a quantitative method, a larger number of respondents could be reached which could be used to confirm or confute the findings of this research. This would be useful for mapping present or new patterns in the ways SMEs interact, both on regional and national basis, for market development. Studies which investigate SMEs within different industries also might be of interest. Future research might also likely involve studies that integrate or create unified knowledge and methods between different disciplines. To support this aim, the quintuple helix model (Carayannis & Campbell, 2010) could once again constitute a promising tool for the promotion of sustainable development, due to both its interdisciplinary and applicability.

Acknowledgements

This project would not have been possible without the input and support of some vital actors.

First of all, my deepest gratitude towards my mentor Cecilia Mark-Herbert, associate professor at the Swedish University of Agricultural Sciences, for giving me the opportunity to carry out this project. Her support throughout the entire research process has been most inspiring and valuable for the development of my research.

I would like to thank each and every one of the companies and actual respondents that participated in this project. Janina Östling at IsoTimber Holding AB, Björn Visell at Nock Massiva Trähus, Stefan Gustafsson at Älö Trä Vimmerby, Peter Lindberg at Spacem2 For smart living, and Niklas Andersson at Sizes Works. I am very grateful for sharing your time and professional insights.

I would also like to thank Linda Höglund, associate professor at School of Business, at Mälardalen University, for her knowledge and counselling related to specific segments of the method and analysis of this project.

A special thanks goes also to my father, who has supported me and contributed with helpful tips during parts of the project process. He has also read the manuscript to confirm if the content gave a good understanding.

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Appendicies

Appendix 1. Case Study Protocol

Case Study Protocol

Case study	- SMEs involved in the market development of WMC.
Case study background	- Presented in Chapter 3 and Chapter 4.
Research questions	- Presented in Chapter 1.
Data collection methods/sources	- Semi-structured video interviews via Zoom and phone. - Topic-relevant literature.
Data collection procedure and history	- June 15, 2020 – First contact by email, Janina Östling, at IsoTimber Holding. - June 18, 2020 – First contact by email, Urban Bergsell, at Sizes Works. - July 7, 2020 – First contact by email, Stefan Wernholm, at Älö Trä Vimmerby. - July 7, 2020 – Redirected by Stefan Wernholm to Stefan Gustafsson, at Älö Trä Vimmerby. - July 7, 2020 – First contact by email, Björn Visell, at Nock Massiva Trähus. - July 8, 2020 – First contact by email, Peter Lindberg, at Spacem2 For smart living. - July 10, 2020 – Interview by Zoom, Janina Östling, at IsoTimber Holding. - July 15, 2020 – First contact by phone, Stefan Gustafsson, at Älö Trä Vimmerby. - July 15, 2020 – Interview by phone, Peter Lindberg, at Spacem2 For smart living. - July 15, 2020 – Interview by Zoom, Björn Visell, at Nock Massiva Trähus. - July 20, 2020 – Redirected by Urban Bergsell to Niklas Andersson, at Sizes Works/We Are Tomorrow. - July 21, 2020 – First contact by email, Niklas Andersson, at Sizes Works/We Are Tomorrow. - July 23, 2020 – Interview by Zoom, Stefan Gustafsson, at Älö Trä Vimmerby. - July 25, 2020 – Transcript sent to Janina Östling. - July 26, 2020 – Transcript sent to Peter Lindberg. - July 26, 2020 – Transcript sent to Björn Visell. - July 28, 2020 – Interview by Zoom, Niklas Andersson, at Sizes Works/We Are Tomorrow.

	- July 29, 2020 – Transcript sent to Stefan Gustafsson. - July 29, 2020 – Transcript sent to Niklas Andersson. - July 30-August 22, 2020 – Categorisation, analysis, report
Ethical considerations	- Respondents are aware that the interview is being recorded. - The interviews are executed in the mother-tongue of the respondents. - Respondents should have the possibility to validate the transcript as correct formulated.
Interview guide	- Presented in Appendix 1.
Special preparations	- Laptop for enabling video interviews and recording via Zoom. - Smartphone as backup for recording the interviews. - Notepad and pen.
Full list of interviews	- The entire list is presented in Chapter 3.

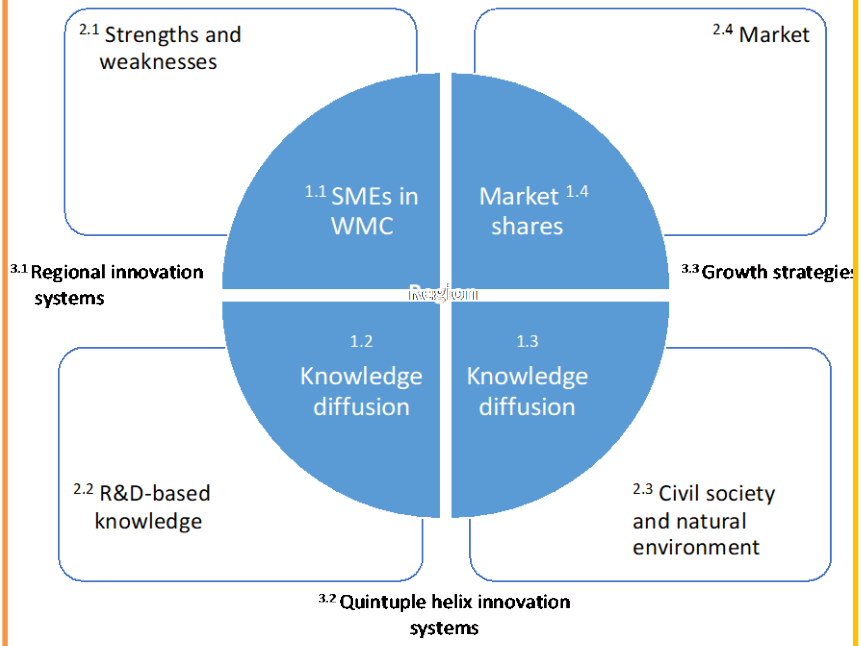
Appendix 2. Interview guide

Introduction

- *What position in the company do you have?*
- *For how long have you had this position?*
- *Please, describe briefly about the vision of the company concerning wooden multi-story houses?*

Head questions

- *How do You work in order to develop innovative solutions in the matter of wooden multi-story housing within Your zone of accumulation?*
- *How do You work with local collaborations or projects?*
  - *How do You look at the distribution of roles within these collaborations?*
- *Where do You get access to research and development within Your line of business?*



Head questions

- *What do Your plans of marketing expansion, in terms of wooden multistore houses, looks like today?*
- *Which advantages and drawbacks do You see for Your and other smaller firms compared to larger firms within the building sector?*
- *What do You think firms like Yours, must do to succeed in creating competitiveness with intention to raise market shares for wooden multistore*

Head questions

- *In which ways will construction of wooden housing contribute to a sustainable development?*
- *Which actors do You see as important in participating in local collaborations or projects?*
- *How do You work with communication according to the qualities of wood as building material?*
  - *What do Your designs of communication looks like?*

Conclusion

- *Which approaches, in order to create competitiveness and innovation within the construction sector in terms of wood, do You think will be increasingly more existent in the future?*

Appendix 3. Informed consent (GDPR)

Sveriges lantbruksuniversitet
Swedish University of Agricultural Sciences

Skogsfakulteten
Institutionen för skogsekonomi
Avdelningen för industriell ekonomi

EV. DOKUMENTTYP SLU ID: SLU.[Skriv numret här]

2020-.....

Samtyckeblankett: Personuppgiftsbehandling i studentarbeten

När du medverkar i examensarbetet med *Promoting sustainable market development - A case study of multi-storey construction* (arbetstitel) innebär det att SLU behandlar dina personuppgifter. Att ge SLU ditt samtycke är helt frivilligt, men utan behandlingen av dina personuppgifter kan inte forskningen genomföras. Denna blankett syftar till att ge dig all information som behövs för att du ska kunna ta ställning till om du vill ge ditt samtycke till att SLU hanterar dina personuppgifter eller inte.

Du har alltid rätt att ta tillbaka ditt samtycke utan att behöva ge några skäl för detta. SLU är ansvarig för behandlingen av dina personuppgifter, och du når SLUs dataskyddsombud på dataskydd@slu.se eller via 018-67 20 90. Din kontaktperson för detta arbete är: Gustaf Braunstein, gustaf.braunstein@gmail.com, 0763382308.

Vi samlar in följande uppgifter om dig: ditt för-och efternamn, vilket företag som du arbetar för, och positionen som du har inom företaget.

Ändamålet med behandlingen av dina personuppgifter är att SLUs student ska kunna genomföra sitt examensarbete enligt korrekt vetenskaplig metod och bidra till forskning inom marknadsutveckling, hållbar utveckling och innovation (*market development, sustainability, innovation*).

Om du vill läsa mer information om hur SLU behandlar personuppgifter och om dina rättigheter kan du hitta den informationen på www.slu.se/personuppgifter.

Jag samtycker till att SLU behandlar personuppgifter om mig på det sätt som förklaras i denna text, inklusive känsliga uppgifter om jag lämnar sådana.

Underskrift Plats, datum

Namnförtydligande

Postadress: Box 7060, 750 57 Uppsala
Besöksadress: Ulls väg 27
Org nr: 202100-2817
www.slu.se

Tel: 018-67 10 00 (vx)

Examensarbeten / Master Thesis
Inst. för skogsekonomi / Department of Forest Economics

1. Lindström, H. 2019. Local Food Markets - consumer perspectives and values

2. Wessmark, N. 2019. Bortsättning av skotningsavstånd på ett svenskt skogsbolag - en granskning av hur väl metodstandarden för bortsättningsarbetet följts

3. Wictorin, P. 2019. Skogsvårdsstöd - växande eller igenväxande skogar?

4. Sjölund, J. 2019. Leveransservice från sågverk till bygghandel

5. Grafström, E. 2019. CSR för delade värderingar - En fallstudie av kundperspektiv hos skogs- och lantbrukskunder inom banksektorn

6. Skärberg, E. 2019. Outsourcing spare part inventory management in the paper industry - A case study on Edet paper mill

7. Bwimba, E. 2019. Multi-stakeholder collaboration in wind power planning. *Intressentsamråd vid vindkraftsetablering*

8. Andersson, S. 2019. Kalkylmodell för produkter inom korslimmat trä - Fallstudie inom ett träindustriellt företag. *Calculation model for products within cross-laminated timber - A case study within a wood industrial company*

9. Berg Rustas, C. & Nagy, E. 2019. Forest-based bioeconomy - to be or not to be? - a socio-technical transition. *Skogsbaserad bioekonomi - att vara eller inte vara? - En socio-teknisk övergång*

10. Eimannsberger, M. 2019. Transition to a circular economy - the intersection of business and user enablement. Producenters och konsumenters samverkan för cirkulär ekonomi

11. Bernö, H. 2019. Educating for a sustainable future? - Perceptions of bioeconomy among forestry students in Sweden. *Utbildning för en hållbar framtid? - Svenska skogsstudenters uppfattningar av bioekonomi*

12. Aronsson, A. & Kjellander, P. 2019. Futureshandel av rundvirke - Möjligheter och hinder för en futureshandel av rundvirke. *A futures contract on roundwood - Opportunities and barriers for a futures trade on roundwood*

13. Winter, S. 2019. Customers' perceptions of self-service quality - A qualitative case study in the Swedish banking sector. *Kundernas uppfattning om självbetjäningskvalitet*

14. Magnusson, K. 2020. Riskanalys av hybridlärk (*Larix X marschlinsii*) - Möjligheter och problem. *Risk analysis of hybrid larch (Larix X marchlinsii) - Opportunities and problems*

15. Gyllengahm, K. 2020. Omsättningslager för förädlade träprodukter - en avvägning mellan lagerföring - och orderkostnad. *Levels of cycle inventory for processed wood products - a trade-off between inventory - and order cost*

16. Olovsson, K. 2020.Ledtider i sågverksindustrin – en analys av flöden och processer. *Lead times in the sawmill industry – an analysis of flows and processes*

17. Holfve, V. 2020. Hållbart byggande – Kommuners arbete för flerbostadshus i trä. *Building in a sustainable way –Municipalities' work for wooden multistory constructions*

18. Essebro, L. 2020. Ensuring legitimacy trough CSR communications in the biobased sector. *Att säkerställa legitimitet genom CSR kommunikation i den biobaserade sektorn*

19. Gyllengahm, K. 2020. Making material management more efficient – reduction of non-value-adding activities at a wood products company. *Effektivisering av materialflödet – reducering av icke värde-adderande aktiviteter på ett trävaruföretag*

20. Berg, E. 2020. Customer perceptions of equipment rental – Services for a circular economy. *Kunders uppfattning av maskinuthyrning – Serviceutbud och cirkulär ekonomi*

21. Emerson, O. 2020. Impacts of environmental regulations on firm performance – the development of a new perspective. *Påverkan av miljökrav på företags prestanda – utvecklingen av ett nytt perspektiv*

22. Essebro, L. 2020. Communicating a climate friendly business model. *Att kommunicera en klimatvänlig företagsmodell*

23. Halldén, A. 2020. Skogens roll i klimatfrågan – En medieanalys av Dagens Nyheter 2010–2019. *The role of forests in the climate discourse – a media analysis of Dagens Nyheter 2010-2019*

24. Gebre-Medhin, A. 2020. Swedish FES-related policy: Integration of national objectives and factors affecting local actors' policy respons

25. Tanse, K. 2020. The Swedish policy framework for Forest Ecosystem Service. A study of integration of objectives, policy instruments and local actor's knowledge about policies and policy objectives

26. Braunstein, G. 2020. Promoting sustainable market development – A case study of wooden multi-story buildings. *Att främja en hållbar marknadsutveckling – En fallstudie om flervåningsbyggande i trä*