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On the road to commercialize autonomous road mobility

A case study of a scale-up to determine how four critical factors influence international business model scalability

Master thesis in Management and Economics of Innovation

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Division of Entrepreneurship and Strategy
Gothenburg, Sweden 2021
www.chalmers.se
Report No. E2021:028

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Abstract

Reaching profitable growth for a startup is a difficult quest. Finding a viable business model that is possible to scale internationally is vital for a scale-up to succeed. This becomes especially critical when working with technology innovations because of their novelty and associated uncertainty. The applications of autonomous road mobility are currently gaining traction, partly because autonomous road mobility is seen to mitigate inefficiencies. Increasing the efficiency of road mobility has great potential to reduce the sector's negative impact on sustainability, as it is currently responsible for 18% of the world's greenhouse gas emissions. The advancement of the technology necessary suggests that widespread usage of autonomous road mobility is approaching. This highlights the importance of conducting research on what role the business model has on facilitating the commercialization of the technology, which is essential to maximize the sustainable impact of autonomous road mobility.

The purpose of this thesis is to provide knowledge about scale-up companies working with autonomous road mobility and how these companies can affect the international scaling process. Little prior attention has been given to factors affecting business model scalability. To contribute to research, the following research question was chosen: *How do the factors Legal Frameworks, Complementary Technologies, Customers, and Teams affect international business model scaling for a scale-up company working with technology innovations in autonomous road mobility?*

The research approach for this study was qualitative and abductive, designed as a single-case study. The data was collected via interviews at a case company. Findings show that first, the factors Legal Frameworks and Customers mostly affected the scaling process negatively, mainly because these factors include aspects that are difficult for a company to control. This complicates the scaling process as it impedes product development and introduces uncertainty. Second, it was found that the factors Complementary Technologies and Teams mainly affect the scalability positively long-term and that the scale-up has bigger opportunities to control these effects. Third, by investigating the interrelations between factors, it was found that the factor Complementary Technologies was the one affecting most other factors. This relation mainly increased already positive effects on scalability or mitigated negative effects.

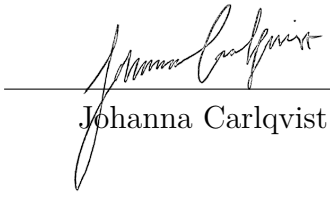
Keywords: business model scalability, autonomous mobility, scale-up, autonomous vehicle, technology innovations, complementary asset, technology adoption curve.

Acknowledgements

This report is the result of a master thesis project carried out during the spring of 2021 by two students at the Department of Technology Management and Economics at Chalmers University of Technology. The thesis finalizes the master program Management and Economics of Innovation and five years of engineering studies at Chalmers University of Technology. The thesis was focused on how four different factors affect international business model scaling of companies working with technology innovations in autonomous road mobility.

This thesis would not have been possible to conduct without the support and dedication of several individuals. Firstly, a special thanks to everyone at the case company who participated in the interviews and dedicated their time to answer our questions. Your transparency, input, and commitment have been crucial for our thesis, and it was genuinely inspiring to hear your thoughts about the future. Secondly, we owe our greatest gratitude to our company supervisor Jéromine Maillet, whom we are very thankful to have gotten the chance to work closely with. Your help to understand the structure of the case company and guidance during the interview process was of great help. We are especially thankful for the extra effort you devoted to giving us advice on academic writing.

Further, we want to thank our university thesis supervisor, Adrian Bumann, from the Department of Technology Management and Economics at Chalmers University of Technology, who has supported and guided us through the thesis process. We are thankful for your quick responses, agility when it came to feedback, and help to develop a structured academic report. We would also like to thank our examiner at Chalmers, Professor Robin Teigland, who has given us insightful and wise feedback on our work. Finally, thanks to our former lecturers and associate professors Christian Sandström, Marcus Holgersson, and Henrik Berglund for their support regarding the localization and interpretation of pertinent literature. Thank you.



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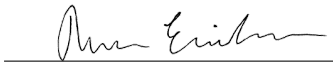

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Gothenburg, Sweden
June 2021

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1
Introduction

Start-ups and scale-ups play important roles within a country's economy. The European Commission even states that start-ups are possibly "the future drivers of economic growth and job creation within the European Union." (EU Startup Monitor, 2019). For companies originating from small countries with a limited market size, it is beneficial not only to scale their businesses nationally but also internationally. This research aims to investigate the specific issue of scale-up companies working with technological innovations within autonomous road mobility, looking to scale their business model internationally. The area of autonomous road mobility has the potential to positively impact the environment (Mersky and Samaras, 2016). To maximize the sustainable impact of autonomous road mobility, it is important to promote commercialization. By researching this topic closer, it is possible to help managers and owners of scale-up companies within autonomous road mobility to understand how some complex factors will affect the scalability of their business model. The research's findings will hopefully also help overcome these obstacles and thereby enable the companies to, in line with the statement from the European Commission above, boost the economy and make innovative technology available, which is beneficial for society as a whole.

The following chapter aims to describe the background to why the thesis is conducted, clarify essential concepts, as well as defining the research gap. Further, the purpose of the thesis will be described in greater detail, and finally, the research question and the four factors investigated will be introduced.

1.1 Background

The advancement of the economy and the progress of societal development are heavily influenced by innovations that often are made public through start-ups. The difficulties for a start-up seem not to be culminating in finding a viable product, but finding a viable business model to commercialize the product through and thus ensuring a critical mass of users or customers (Chesbrough, 2010, Evans and Schmalensee, 2010). For businesses to survive in the long term, it is crucial to ensure continued growth to not fall behind and become obsolete, or be overtaken by another company (Quelle, 2012). This is especially true for start-ups as these are often backed by venture capital investors seeking high future returns, and thereby also profitable growth (Hallowell, 2001), stressing the importance of growth even further. Start-ups later evolve to scale-ups on their way to becoming an established

company. An exact definition of what a start-up is and how it differs from a scale-up is lacking, which makes it difficult to separate the two concepts. In this thesis, the following definitions from The Startup Europe Partnership (SEP) and The Organisation for Economic Co-operation and Development (OECD) will be used.

The SEP, part of the European Commission, proposes a definition of start-ups based on its fundamental challenge; searching for a repeatable, scalable business model including a viable product offering (Onetti, 2014). Not every newly founded company is a start-up, for instance, a hair salon is usually not a start-up, because it is not intended to scale (Graham, 2012). Building on that definition, a scale-up has finished the search and is challenged by executing the business model and ensuring exponential profitable growth (Onetti, 2014). Reasons to scale could possibly be to manage a major demand increase, capture new opportunities, or improve the competitive position. Growth can be defined in several ways. For instance, Brännback, Carsrud, and Kivilouto (2014) mention profitability growth, employment growth, and the time to reach high growth as the most important dimensions of growth. Damodaran (2009) instead highlights revenue and operation margin growth.

The OECD defines high-growth enterprises as companies that have a minimum of 10 employees and have had 20% annual growth in either employment or turnover over a three-year period (Eurostat and OECD, 2007). The European Commission uses the terms high-growth company and scale-up company interchangeably in their reports (OECD and the European Union, 2019), however, the European Commission (2020) has recently lowered the threshold to 10% annual growth. Others use the definition based on venture capital which implies that a scale-up has existed for maximum of 10 years and has raised more than 1 $ million in investments (Hoffmann, 2016). This can be misleading as older companies are also able to scale as well as companies building scale on revenue instead of investments.

Business model is another insufficiently defined concept used in various ways. Perhaps the simplest way to describe it is as a simplified description of a business (Grant, 2016). Grant (2016) questions if there is any difference between business models and business strategy and highlights the importance of establishing goals that are consistent and long-term to reach success. Gilbert, McDougall, and Audretsch (2006) points out that strategy is included in the most important predictors of growth in new businesses. Hence the close connection between strategy and business models, it can be concluded that business models as well are important for growth. Joining with the concept of scalability, business model scalability can thus be defined as the business model's ability to accelerate revenue growth quicker than costs increase. Initially, there might be a trade-off between scaling and increasing profits, as scaling is expensive, but the business model should be built in a way so that future revenue growth outpaces cost additions. Stampfl, Prügl, and Osterloh (2013) describes the key role of a scalable business model for a company's successful growth and further states several factors important for a company to consider when scaling. Stampfl et al. (2013) present a model including these factors, which will be used throughout this thesis.

Furthermore, the thesis considers technology innovations. Rogers (2010) argues in his book that technology consists of two units, the hardware component which is a physical object, and the software component which contains the foundation of information of the hardware. Innovation is defined here as the introduction of something new which adds value or knowledge to the company or its customers (O'Sullivan and Dooley, 2008). The technology innovations under investigation in the thesis concern autonomous road mobility. Throughout the thesis, the term autonomous road mobility is used to describe the whole sector, while the term autonomous vehicle (AV) will be used to refer to the actual vehicle and the hardware. Autonomous road mobility is seen as a way to mitigate inefficiencies in transportation (Mersky and Samaras, 2016), as it increases fuel economy, eco-friendly driving, and allows for better routing and maximized usage of a vehicle. However, it has yet to become used commercially, as technology is still developing and currently insufficient for public use (Koopman and Wagner, 2016). Making the road mobility sector more efficient has great potential to reduce the sector's impact on sustainability, as it is currently responsible for 18% of the world's greenhouse gas emissions (International Energy Agency, 2020).

1.2 Problem Identification

The current pertinent literature comprises an abundance of tips, best practices, and opinions on how to make a start-up succeed and scale, mainly written by experienced entrepreneurs and not published as academic literature. There is also a vast amount of academic research connected to business models available. However, when it comes to business model scalability, research shrinks drastically and is mainly focused on digital businesses. Stampfl et al. (2013) stated already in 2013 that little attention had been given to the factors affecting business model scalability, and after searching for literature within this area, this still seems to be true. Web of Science gives around 5000 results when searching for "autonomous vehicle" in the title, abstract, and keywords, and shows that there has been substantial growth within the area during the last decade, from just over 100 published papers in 2010 to almost 1000 in 2019. Present academic literature on autonomous road mobility is heavily focused on technological issues and progress, as well as practical implications for policymakers framed to facilitate the commercialization. The focus on how business models could help the commercialization of autonomous road mobility is however limited. (https://www.webofknowledge.com). A 30% decline in numbers of publications between 2019 and 2020, (https://www.webofknowledge.com), could potentially narrate that the unresolved technological issues are decreasing and that widespread usage of autonomous road mobility is approaching. This highlights the importance of conducting research on what role the company and its business model have on facilitating the commercialization of the technology and how different factors might affect the process.

1.2.1 Purpose and Research Question

The purpose of this thesis is to provide knowledge about scale-up companies working with technology innovations in autonomous road mobility and how these can facilitate the international scaling process. This will fill a gap in currently available research around business model scalability, highlight potential hindering factors for scaling, provide practical implications for managers of scale-up companies, and enable a positive impact on the economy and the environment. To fulfill the purpose of the thesis the following research question was formulated:

How do the factors Legal Frameworks, Complementary Technologies, Customers, and Teams affect international business model scaling for a scale-up company working with technology innovations in autonomous road mobility?

1.2.2 Description of Chosen Factors

To narrow down the thesis scope, four factors were selected. These four factors were identified in the literature as important determinants of the success of scaling companies, mainly based on the work of Stampfl et al. (2013). These factors have been identified as particularly relevant at the involved case company and are therefore the focus of this thesis. Below follows a short description of what each factor comprises.

Legal Frameworks
Concerning the legal changes that are needed for the introduction of autonomous road mobility into the regular transport system internationally. Currently, laws are not adapted to autonomous road mobility and are not harmonized globally.

Complementary Technologies
Two or more complementary technologies enable each other's existence and increase the total value of the offer as a part of a greater ecosystem. Business models intertwining physical and digital aspects are increasing in appearance. These possibly create challenges to linking the physical and digital technologies as well as making strategic decisions regarding the development of the technologies.

Customers
Concerning both management of current customers and customer acquisition. As autonomous road mobility is still novel, the target customers are early adopters, but this market is arguably not big enough to ensure sustainable revenue.

Teams
The teams consist of individuals with different backgrounds and mindsets that affect the group. Rapid scaling involves integrating new employees and strategic decisions regarding hiring.

2
Theoretical Framework

The following chapter presents current pertinent literature in the areas of Business Models Scalability and four factors with possible effects on the scalability of companies working within autonomous road mobility. The factors are; Legal Frameworks, Complementary Technologies, Customers, and Teams.

2.1 Business Model Scalability

In this section, a brief overview of the history of business models, the logic behind them, and how they can be connected to scalability will be presented.

2.1.1 The Logic of Business Models

The interest in business models is relatively novel (Morris, Schindehutte, and Allen, 2005), and is, according to Morris et al. (2005) and Amit and Zott (2001) built upon a combination of central recognized theories within business strategy. Mentioned by Morris et al. (2005) is Porter's value chain framework (Porter, 1985), the theory of transaction cost economics by Williamson (1981), strategic network theory by Jarillo (1995), cooperative strategies by Dyer and Singh (1998) and the resource-based view of a firm by Barney, Wright, and Ketchen Jr (2001). As value creation is a central theme of business models, it is also influenced by Schumpeter (1936) theory on economic development.

As introduced in the 1.1 Background section, the concept business model has no set definition. According to Zott, Amit, and Massa (2011), the lack of a common language spurs confusion and diverts energy from the actual research. Previous research, as Osterwalder and Pigneur (2010) and Zott and Amit (2007), propose that the business model concept is part of strategy, while others view it as a stand-alone concept (Baden-Fuller and Haefliger, 2013; Teece, 2010). Sorescu, Frambach, Singh, Rangaswamy, and Bridges (2011) claim that the strategy of the firm illustrates a goal, and the business model is the vehicle that advances the firm towards the goal. Common ground is however found in the notion that business models link the firm's value creation and value capture (Amit and Zott, 2001; Casadesus-Masanell and Ricart, 2010; Teece, 2010; Baden-Fuller and Haefliger, 2013). (See Appendix D.1 for further information).

According to Morris et al. (2005), what business models describe can be divided

into three categories: economic, strategic, and operational. The economic category describes the value proposition, the source of profit, and the sustainability of the revenue stream. The strategic category describes the firm's market positioning, target customer groups, and the opportunities for growth, while the operational category describes the organizational structure, management, and internal processes.

Flamholtz and Randle (2007) agrees with Morris et al. (2005), but further highlights another perspective on a growing firm's strategy of prioritizing to develop the company into what it aspires to become. This focus on a long-term vision is agreed upon by Sutton and Rao (2014) who stress the importance of basing decisions not on short-term goals, but on what will be beneficial in the future, even if it does not seem rational at the present. This relates to the "Eisenhower Principle" of distinguishing urgent matter from important, where urgent tasks demand immediate attention but are often not related to long-term goals. In contrast, important tasks are seldom urgent but directly impact future success. (Brunnert et al., 2015).

This could be linked to Christensen's claims about disruptive technology and innovation. The root cause of incumbents' inability to overcome disruption lies not within the technology itself, but in the conflict between the already established business model and the new business model required to deliver and capture the value of the new technology. (Christensen, 1997).

What can be concluded is that business models are a way of describing the core of a firm. The design of a business model is formulated with regard to the specific company and its situation. It usually emerges over time and is tested and experimented with as it is put into practice, to find a viable business model that both delivers and captures value.

2.1.2 Growth vs. Scalability - is there a difference?

The concept of scalability builds on the basic economic theory of economies of scale and scope. A larger scale or scope brings cost advantages as the unit cost decreases. Nielsen and Lund (2018) propose two dimensions of scalability: "The first dimension is the degree to which increased input can create higher output. The second dimension of scalability relates to the ability of the business model to accelerate returns on the additional investment." (p. 66). The vital difference is that scalability refers to profitable growth where revenue is increasing at a considerably faster pace than costs are increasing, whereas growth is a broader concept meaning to explain the general enlargement of a firm. Growth can occur without any substantial increase in profitability as costs grow at the same pace as revenues. A scalable business model is therefore built in a way so that the same resources can handle more output over time. This will generate consistent revenue growth in the long run.(Carucci, 2016). Scaling can thus be seen as profitable growth or the path to future profitable growth.

This implies that literature on growth is relevant for this thesis. A well-cited article on the topic is Greiner's "Evolution and Revolution as Organizations Grow", where

Greiner (2018) proposes five different phases of organizational growth and that the transitions between the phases are seldom pleasant or occur smoothly. Instead, he refers to the transitions as stages of internal crisis. To overcome the crisis, different changes in organizational structure are needed depending on what phase the firm is in. These changes are often linked to management practices, and it is important to plan for future growth and the upcoming crises. Harnish (2014) enhances the understanding that growth is far from easy and presents the paradoxical logic with growth; as resources and opportunities grow, things should get easier, the opposite is often true.

Greiner (2018) further claims that the growth rate is affected by the industry the firm operates in. If the industry is under change or development and favours rapid expansion, the need for new organizational structures is accelerated (Greiner, 2018). The OECD (2018) agrees with this, stating "the drivers of high growth are strongly influenced by the underlying business environment". Related to markets is the firm's growth potential, the revenue that potentially could be captured by growth is often correlated to market size (Bhide, 2000).

Commonly recognized is that high growth is a transitory phase (OECD, 2018, Greiner, 2018, Harnish, 2014), and Moore and McKenna (1999) claim that growth seldom happens exponentially from the very beginning. Instead, growth happens gradually in lumps, as the target customers will change over time and have significantly different needs. This will be further discussed in section 2.2.3 Customers.

2.1.3 Business Model Scalability Explained

The concepts of business models and scalability are important for this thesis, and jointly they become one of the central themes, namely business model scalability. As described in the 1.1 Background section, business model scalability can be defined as the business model's ability to accelerate revenue growth quicker than costs increase. The accelerated revenue growth must not occur instantly, but the business model needs to have the potential for it (Nielsen and Lund, 2015). Furthermore, the act of scaling a business is in this thesis synonymous with employing a scalable business model.

As previously mentioned, scalability is closely connected to economies of scale and scope. This parallel can be extended also to business models. Traditionally, to create competitive advantage, companies have chosen between business models focusing on either achieving economies of scale or economies of scope. Nielsen and Lund (2018) searched for the sweet spot of business model scalability and identified five attribute patterns of business models that were flexible and where the potential of accelerating returns on investments was not constrained by physical resources. These involve for instance to overcome traditional capacity constraints within the industry, avoiding huge capital requirements and investments by shifting some to strategic partners, and implementing platform business models, and rethinking competitors as partners or customers (Nielsen and Lund, 2015).

The scalability of business models is not binary, they are not either scalable or not. Instead, they can be more or less scalable. Even though his research is focused on e-commerce businesses, the "scalability continuum" Hallowell (2001) presents could be adapted to suit other types of businesses as well. Hallowell (2001) describes businesses that offer pure information at the far high end of the continuum, and businesses offering highly customized offers that require new processes of physical service every time at the opposite end. Physical service is inversely proportional to a business model's scalability potential. The more complex the physical service becomes and the more the physical service is an integral part of the offering, the less scalable. As the physical service constrains the scalability, it is important for firms to analyze and understand where their limit of scalability is. (Hallowell, 2001). Hallowell (2001) research furthermore implies that the more that can be done digitally, the easier it is to scale. Digitalization offers opportunities for scaling up, and digital technology presents benefits like access to wider markets, better modes of communication, new technology, and appropriate talent. To access the full hypothetical benefits of digital transformation, the skills of employees need to be upgraded (OECD, 2018).

The use of technology is significant for scale-ups, as it enables scalability (Stampfl et al., 2013). The scalability of businesses is connected to technological scaling, which refers to a systems' ability to increase output or handle increasing work while resources are added (Nielsen and Lund, 2015). Huang, Henfridsson, Liu, and Newell (2017) emphasize the role digitalization has for scalability of companies and highlight that it is significantly different from the scaling of big industrial companies that has been researched by Chandler (1962). Especially highlighted is the significant leanness of growth that can be identified at digital companies. Huang et al. (2017) suggest that digital ventures can scale at an unprecedented pace, which they call "rapid scaling". Rapid scaling is defined as a generative process, where the user base is expanded quickly during a short period of time. Generativity is defined as the system's ability to create new output without input from the originator (Zittrain, 2006), and in this case, the process is generative in the sense that initial users increase the likelihood for additional users, without a parallel increase in effort spent on getting those customers (Huang et al., 2017). This is similar to the consequences of network effects which Stampfl et al. (2013) raises as one positive factor for scaling digital businesses. Digital businesses can use the mechanisms of *data driven operation* where data is used to understand customers and making decisions, *instant release* which means that the time gap between an innovation or upgrade and the delivery to the user is minimized, and finally *swift transformation* which allows firms to change their business model quickly if needed (Huang et al., 2017). These mechanisms facilitate scalability and are difficult to achieve for non-digital companies. Stampfl et al. (2013) are taking it one step further and claim that the software-as-a-service business model shows "perfect scalability".

2.1.4 An Explorative Model of Business Model Scalability

This thesis is especially anchored in the works of Stampfl et al. (2013), and their explorative model of business model scalability, see figure 2.1. Their research is one of the earliest concerning how different factors influence business scalability and their findings resulted in a model for understanding the workings behind a scalable business model. It identifies implications of the conceptualization and implementation of the business model to ensure scalability. Stampfl et al. (2013) highlight the importance of implementation; a business model can be designed in a way that allows for scalability, but still fail if the realization is not carried out in a proper way. With that being said, the research focus gravitates more towards the design and conceptualization of business models.

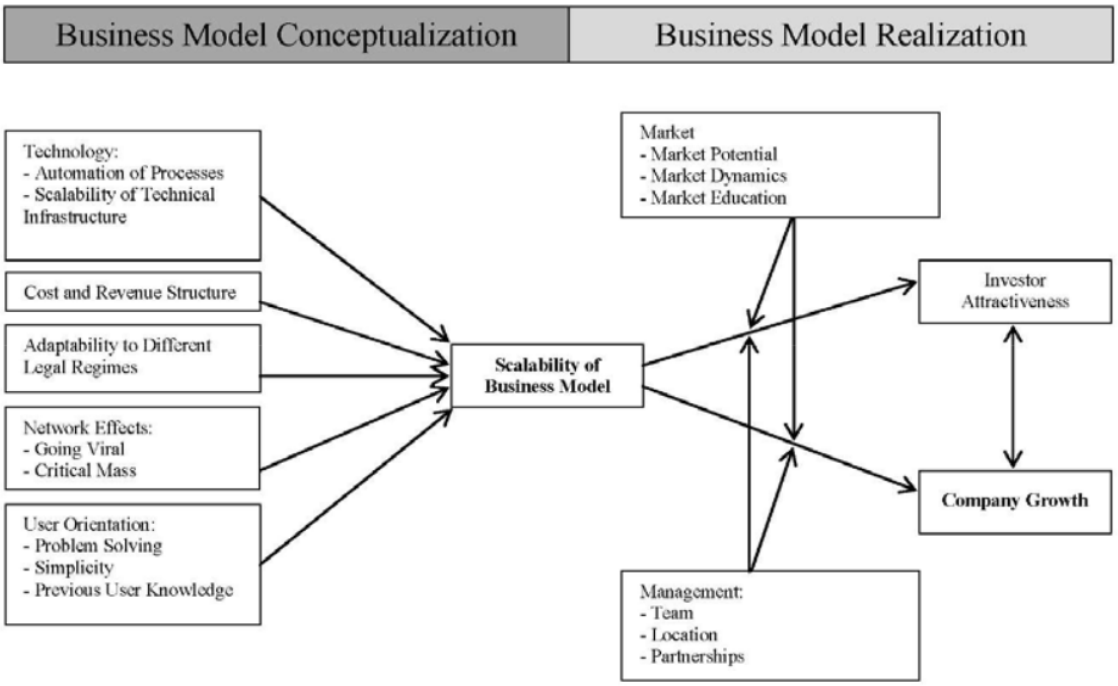

Figure 2.1: From "An explorative model of business model scalability" by Stampfl, G. and Prügl, R. and Osterloh, V., 2013, International Journal of Product Development, 18(3-4), p. 226-248.

The model consists of five mutually exclusive factors that influence the scalability of business models through conceptualization. Additionally, two moderating factors, Market and Management, are presented that can enhance or moderate the effect of the business model in the realization stage. These seven factors influence the success of the two possible outcomes that also internally influence each other, investor attractiveness and company growth. Stampfl et al. (2013) claim that a scalable business attracts investors, and that financing from investors helps to scale the business.

All five factors influencing business model conceptualization can be found in Appendix D.2, below the three factors relevant for this thesis is presented:

1. Technology
   Proper use of technology significantly influences the scalability of a business model and is often times the part that enables scalability. It encompasses automation of processes to reduce fixed costs as well as the scalability of technical infrastructure to support more users without loss in quality.

2. Adaptability to different legal regimes
   If a business model only needs small adaptations to work abroad, under different legal regimes, it will significantly increase scalability. Legal restrictions can inhibit international operations, and if the business model has not taken this into account, it will either prevent the business to grow within certain countries or need considerable extra work to adapt. Geographical expansion can thus become both constraining and expensive.

3. User orientation
   The model highlights the importance of keeping customers and their wishes central and focusing efforts on solving existing problems (market pull). This in contrast to a technology push. This requires user knowledge and problem-solving. The number of users with a problem positively influences the scalability, as does the simplicity of the solution.

Beyond these factors, Stampfl et al. (2013) also introduce moderators that will affect the success of the conceptualization of a scalable business model. The idea is that identical business models will have different outcomes depending both on the specific environment and the execution. Thus, the market and management are the two moderating factors.

1. Market
   The market potential of the target market segment is an important influence on growth, the bigger the volume, the likelier for the firm to grow rapidly. Market dynamics are also affecting success but can be insidious. It is necessary to ensure that the timing of the business model realization is aligned with the market. If the market is changing quickly and is highly dynamic, the business model will reach its full potential quickly, and then become obsolete as the market changes again. Therefore, it is important to grow along with the market dynamics. Furthermore, market education and complexity of the offer are highlighted, both to have inhibiting and supportive effects. Difficulties to enter a market arises when potential customers need to be educated to understand the offer and why they need it. This requires investments which hinders scalability. On the other hand, if the market is in need of education, fast followers can draw an advantage if a pioneering firm has laid the groundwork.

2. Management
   This factor includes most parts of the organizational structure of how the firm

is organized and run but focuses mainly on the employees of the team, the location where the firm operates, and the partnerships. The team is viewed as the base of scalability, and their experience and communication internally are important for growth. As many successful startups originate from the same geographical locations, e.g. Silicon Valley and London, the environment is considered important. Firms are dependent on the access of resources in their local environment.

2.1.5 International Business Model Scalability

The international aspect will in this subsection be added to the concept of business model scaling, as there are important insights from research on internationalization that may affect companies seeking to scale their business model internationally. The term *international business model scalability* will be used throughout this thesis to cover this phenomenon.

The concept of internationalization is extensively mentioned in academia. When a firm crosses a national border (Schweizer, Vahlne, and Johanson, 2010), or "the process of increasing involvement in international operations" (Welch and Luostarinen, 1988, p. 36) are two rather broad definitions of the concept internationalization in relation to business management. Porter (2011) stresses increases in quality, speed, efficiencies of communication, and possibility for cross-border transportation as drivers for international expansion. Further, the increased homogeneity of markets around the world accelerates the emergence of international businesses (Hedlund and Kverneland, 1985). An international firm has access to a bigger market than a domestic firm, potentially enabling a higher revenue. Thus, internationalization could create growth opportunities for a scale-up company looking to expand their market and customer base. Although, psychological distance seems to be of special interest during the internationalization process (Hornell, Vahlne, and Wiedersheim-Paul, 1972). Psychological distance is the sum of factors that prevents information flow from and to the market and therefore hinder requiring knowledge about the market. The distance can take several forms, for example, language, culture, level of education, political systems, and industrial development. It is further argued that a company is more likely to expand their business to a country that is close geographically. (Johanson and Vahlne, 1977).

2.1.5.1 Internationalization Models

Early literature on multinational firms focuses mostly on large, well-established firms (Chandler, 1986). Internationalizing through incremental steps is the foundation of the *Uppsala Model*, (Johanson and Vahlne, 1977), which is one of the earliest models on internationalization. Further, Coviello and Munro (1997) found that network relations affect the internationalization decision and mode of entry on a foreign market. This research is in line with Johanson and Mattsson (1987) who concluded that a network approach is appropriate when examining strategies and actions in

different markets. Continuing on the network approach Coviello and Munro (1997) investigated small software firms' internationalization process and found that this process advanced at a higher pace than what could be expected with reference to the Uppsala Model and developed the *Network Theory*. The following section will focus on *International Entrepreneurship*, an internationalization model that arguably is the most suitable for the scope of this thesis. For more in-depth explanations of the areas the Uppsala Model, and Network Theory, see Appendix C, Internationalization.

International Entrepreneurship
Knight and Cavusgil (1996) present research on firms that internationalize quickly and early in their development process and this research is related to the term international entrepreneurship. McDougall and Oviatt (2000) define the term as "...a combination of innovative, proactive, and risk-seeking behavior that crosses national borders and is intended to create value in organizations" (p. 903). According to Autio, Sapienza, and Almeida (2000), the period from the start of an International Entrepreneurship firm to initial foreign market involvement is usually less than three years.

There are two different terms for firms within the area of international entrepreneurship. Oviatt and McDougall (1994) provide a theoretical base for the concept of an "International New Venture", defined as business organizations "that, from inception, seeks to derive significant competitive advantage from the use of resources and the sale of outputs in multiple countries"(p. 49). Another definition of a company within international entrepreneurship is a "Born Global" firm defined by Knight and Cavusgil (1996, 2004). The firm is described as an early adopter to internationalization and theories about the concept challenges the traditional internationalization theories. Both concepts originate in research regarding entrepreneurial companies and their internationalization at an early stage (McDougall, Shane, and Oviatt, 1994). This means that they expand the business into foreign markets and become comfortable in the international arena from an early stage of their development. These firms were first seen in countries with small domestic markets but are now common. (Knight and Cavusgil, 2004). The terms "Born Global" and "International New Ventures" have been used interchangeably although there is a proven difference between the two. The Born Global firms have a more global focus whereas the International New Venture focus more regionally. (Paliwoda, Slater, and Crick, 2009). In this thesis, there will be no segregation between global or regional internationalization. The definition of international entrepreneurship by McDougall and Oviatt (2000) and the firm-specific definition of an international new venture by Oviatt and McDougall (1994) are the ones that will be used in this thesis.

The difference between a company pursuing international entrepreneurship and a company following the Uppsala model is that the former does not incrementally transition towards becoming more international (Johanson and Vahlne, 1977), hence transitioning is never a state, the firm is international from start (Knight and Cavusgil, 2004). Further characteristics of a company pursuing *International En-*

trepreneurship is a high level of entrepreneurship. Its managers have a global mindset that generates a global organization and strategy from the beginning. (Knight and Cavusgil, 2004). These entrepreneurs have the ability to link resources from multiple different countries to meet the demand of international markets (Oviatt and McDougall, 1994). Furthermore, Zahra (2005) states that international new ventures tend to learn from foreign markets by following technological trends and new competencies. This way of learning by entering international markets appears to capture the benefits of foreign investment by generating avenues for growth and higher profits (Zahra, 2005).

International business model scaling is a central part of this thesis. A scale-up company looking to scale their business model internationally needs to be aware of what internationalization actually means for the business. The factors that affect the the scaling might get additional dimensions with the internationalization aspect present.

2.2 Factors

In the following section literature regarding the four factors, legal frameworks, complementary technologies, customers and teams will be examined. They will be discussed in the larger context of autonomous road mobility as this is the main focus of this thesis.

2.2.1 Legal Frameworks

The following section presents present legal frameworks in the context of autonomous road mobility, potential legal challenges, and lobbying.

2.2.1.1 Legislative Frameworks Defining Europe

Human errors are viewed as the main reason for accidents linked to road traffic, which autonomous driving systems hope to eliminate (Sun, Olaru, Smith, Greaves, and Collins, 2017). Motor vehicles are comprised of complex systems already today, and to ensure road safety, advanced legal requirements are needed. Adding more sophisticated, technically complex autonomous systems increases the necessity of legislation that is directly applicable to autonomous road mobility. Legislation differs somewhat globally, but at the moment, current legislation is in principle not adjusted for the introduction of autonomous road mobility anywhere, as AVs are distinctly different from conventional vehicles. (Evas, Rohr, Dunkerley, and Howarth, 2018). Evas et al. (2018) proposed that a completely new EU legislation is needed to cover the gaps in the present legal framework and that coordinated legislation at EU-level would minimize transaction costs and chaos caused by the fragmentation of national legal systems. The lack of coordination could lead to barriers to the introduction of autonomous road mobility at a greater scale. (Evas et al., 2018).

The primacy of EU law is a principle that states that EU law prevails if there is a conflict between EU law and national law in a member state. Therefore, EU countries need to follow common EU-legislation (EUR-Lex, no date) (See Appendix B.2 for details). Further, UN member states can be bound by UN legislation if they applied to become a contracting party to a specific treaty or regulation. The EU can conclude an agreement with the UN, the agreement is then legally binding for all the member states, and UN law prevails over EU law if there would be a conflict. This means that the contracting parties need to follow all regulations in signed treaties. (UNECE, no date). One specific treaty that all of EU (except Ireland and Spain), Switzerland, the UK, and Norway have signed and ratified is the Vienna Convention on Road Traffic, which is the basis for national traffic laws ("United Nations, Vienna Convention on Road Traffic", 1968). The convention has been an obstacle to the development of autonomous road mobility as it required a human driver to be in the vehicle and constantly in control over the vehicle. An amendment was made in 2016 to make automated vehicles somewhat conform with the convention, with the requirement that a human can take control over the system at any time (Ilková and Ilka, 2017, "Utredningen om självkörande fordon på väg, Vägen till självkörande fordon, Del 1 och 2", 2018). However, this amendment does not make levels 4-5 of highly or fully AVs legally possible ("Utredningen om självkörande fordon på väg, Vägen till självkörande fordon, Del 1 och 2", 2018) (See Appendix A for details on the Levels of Automation).

The EU, as well as other European countries that are contracting parties, further need to conform to the UNECE, the UN:s economic commission for Europe which handles the coordination of transport. One example is the technical requirements of vehicles. At the present, vehicles sold and used in a country need to conform to the technical requirements of that specific country, which can cause hurdles if these differ greatly. The "World Forum for Harmonization of Vehicle Regulations (WP.29)" works within the UNECE to globally align these technical regulations and is trying to synchronize the EU directives and the UN Regulations. (UNECE, no date). For details on current developments in EU legislation see Appendix B.1.

2.2.1.2 Legal Challenges

As stated previously, the legal governance of autonomous road mobility needs to be clarified before mainstream adoption is possible. If these issues are not addressed, legislation will contain a high degree of uncertainties and be difficult to apply (Taeihagh and Lim, 2019). Most certainly the risk of the uncertainties will hit the injured part and the consumers, and not the owners and producers of the AVs (Evas et al., 2018). There are three branches of law that are significantly important for autonomous road mobility, criminal law, civil law, and administrative law (Ilková and Ilka, 2017). As legislation systems vary on the national level, these classifications of branches are not directly applicable to all countries, but the contents can be found in most legal frameworks.

Criminal Law
Maybe the most obvious branch is criminal law. Two top issues that need to be

clarified relates to what crimes can be committed by an AV and the question of who is criminally responsible when a crime has been committed.

The way legal frameworks are built in Europe is not coherent today, and the basis of legal props is not designed with autonomous systems in mind. One example is that in Sweden some road traffic-related crimes today need the legal prop of intent, namely that the driver caused the accident by intentionally taking a risk or not abiding by traffic rules ("Lag (1951:649) om straff för vissa trafikbrott", 1951). It is not yet clear if it is possible for a system to intentionally not abide by rules. There are also legal requirements of the driver after being part of an accident, like helping injured and notifying other road users ("Trafikförordning (1998:1276)", 1998). Some countries' frameworks are built on the idea of personal guilt and cannot prosecute a legal entity as a whole (Svedberg, 2016). This can further complicate the issue of deciding who is responsible for a crime. It could be the owner of the vehicle, the manufacturer, the person activating autonomous drive, the programmer that built the code, the mechanic, or the network operator if the vehicle lost wireless connection. (Evas et al., 2018).

Criminal law also covers crimes connected to cybercrime and data protection, which are two additional areas that need attendance (Ilková and Ilka, 2017). Part of the system functionality of autonomous road mobility is the collection and procession of a vast amount of data and the sharing of personal data between different actors is inevitable in the future to create an autonomous road mobility ecosystem. As pictures of people are regarded as personal data, the collection could be illegal due to the EU's General Data Protection Regulation (GDPR) law that regulates the collection and storage of personal data, which severely hinders the development and use of autonomous road mobility. GDPR makes no exception for unstructured collection like this (Costantini, Thomopoulos, Steibel, Curl, Lugano, and Kováciková, 2020; Olsson, 2018).

Civil Law

The second branch of law is civil law, which in this context is mainly connected to liability issues (Ilková and Ilka, 2017). There is no common legal framework for civil law in the European Union, but generally, countries' liability legislation distributes liability between drivers, owners, and manufacturers (Evas et al., 2018). Further, the liability for cybercrime and hacking of the operating system needs clarification (Ilková and Ilka, 2017).

For manufacturers working with autonomous road mobility, the discrepancy between national legislation, and thereby the degree of liability risk, can be complicating. The liability risk will be high in European countries with fault-based liability compared to other countries as France, Belgium, and Sweden where the owner of the vehicle is bearing most of the liability. As the legislation regarding traffic liability varies among member states, adjusting EU legislation to cover common legislation for all countries could be problematic for countries applying a different system that the EU decides upon, and might be politically unachievable. States as the Netherlands,

Sweden, and Belgium offer a high level of protection for traffic victims and would not like to lower that, while other member states do not afford to offer the same level of protection. (Dima, 2019). See Appendix B.2 for further explanation of the current liability legislation within the EU.

Administrative Law
Thirdly, the branch of administrative law is important, including general road traffic law. This branch regulates for instance testing, licensing, and registration of vehicles. It also regulates road traffic rules and technical standards. Legal challenges concern if AVs need a driving license and its validity, where AVs are allowed to drive (in special lanes or prohibited from some zones), and what traffic laws the vehicle has to abide (Ilková and Ilka, 2017). Technical limitations can impose criminal actions of AVs, like their inability to distinguish a policeman from an ordinary person (Lindau, 2017). In Sweden, for instance, it is illegal to not follow a policeman's instructions ("Trafikförordning (1998:1276)", 1998).

2.2.1.3 Lobbying

To influence government policy firms can engage in lobbying. If a firm has access to policymakers they are able to anticipate change in the policy environment. If they do not have that access they are subject to facing high transaction costs. (Ozer, Demirkan, and Gokalp, 2013). Ozer and Markóczy (2010) states that firms tend to develop a political strategy, for example, lobbying, as a complement to their innovation strategy. Hence, having access to policymakers gives them the opportunity to anticipate future regulation and accordingly make adjustments in their innovation strategies, increasing or decreasing the investments in the innovation. Having a political strategy in line with the innovation strategy allow firms to rapidly implement their innovation strategy accordingly, set standards, and create entry barriers for further competition (Oliver and Holzinger, 2008). Comin and Hobijn (2005) states that lobbying in favour of current technology has a significant negative effect on new technology diffusion. Their research shows that if there is an incumbent technology the political environment affects the diffusion of technologies even more negatively than if there is no incumbent.

2.2.2 Complementary Technologies

In this chapter, the factor *Complementary Technologies* will be explained. This by bringing up theories about *Innovation Ecosystems*, *Complementary Assets* such as complementary technologies, potential trade-offs regarding resource allocation, and the concept of driving markets.

2.2.2.1 Complementary Assets

Successful commercialization of an innovation does almost always require additional capabilities or assets to be utilized together with the innovation (Teece, 1986). Adner (2006) agrees and states that most innovation cannot succeed in isolation but needs complementary products or assets to attract customers, and adds that these

complements can be innovations themselves. Teece (1986) presents different types of complementary assets, as specialized manufacturing or complementary technologies. He also differentiates between the complementary assets by dividing them into three categories based on the innovations' dependence on the asset. It can be either cospecialized, specialized, or generic. The cospecialized assets are bilaterally dependent on one another, the asset and the innovation enable each other's existence. The specialized assets are complementary assets with a unilateral dependence between the asset and the innovation. The generic assets do not need to be specialized to the specific innovation and are general-purpose assets. (Teece, 1986). Adner (2006) presents complements, a concept similar to complementary assets by Teece (1986), but defines it as other innovations or components needed for an innovation to work, produced within an innovation ecosystem.

2.2.2.2 Innovation Ecosystems

A firm can, by being a part of an innovation ecosystem, enhance the value creation of a firm's innovation and the offer towards the customer. The ecosystem consists of firms under the agreement to collaborate and combine their offer into a customer-facing, coherent solution. (Adner, 2006). Collaborating with other firms in an innovation ecosystems introduces a lot of risk (Adner, 2006), the dependencies between firms can cause an individual firm's best performance to derail. Adner (2006) states that if not all players in an innovation ecosystem succeed, a market may not emerge and the firm's own innovation becomes unsuccessful because of that. Nalebuff and Brandenburger (1997) present three strategies to solve problems with missing complements, all based on the solution to become involved in the development of them. The first strategy is to internally create the complement, the second is to form an alliance with customers, competitors, or suppliers, and the third solution is to set up a proprietary business. By getting involved the dependence on other players in an innovation ecosystem decreases.

In this thesis, the focus will be on technology innovations with a complementary technology that is cospecilized and internally produced within one firm. Due to the cospecilization of the technology innovation and the complement, both being dependent on the other and enabling each other's existence, the term "Complementary Technologies" is used.

2.2.2.3 Resource Allocation

Fundamental in economic theory is the concept of scarce resources and how these resources efficiently should be allocated. Brilhuis-Meijer, Pigosso, and McAloone (2016) writes about *dual innovations* explained as "the simultaneous innovation of a product and a technology to be applied in that product" (p.32). This situation requires good decision-making as trade-offs between the development processes occur (Brilhuis-Meijer et al., 2016). A situation with similar duality is the issue of ambidexterity. Lee et al. (2015) raises the concern about how to allocate resources between exploitation and exploration processes within the organization. It is argued that there is a need to balance the exploitation and exploration by having a dynamic

resource allocation, the same, arguably, applies for a company with internal development of complementary technologies. Klingebiel and Rammer (2014) stresses that the choice of resource allocation strategy even affects innovation performance.

To summarize, Complementary Technologies refer to a technology innovation and its co-specialized complementary technology asset. Both offered by the same company, enabling each other's existence. Although dependency risks are decreased by internalizing the development, trade-offs regarding resources can occur between the two. Further, the novelty of the technology may create a need to drive the market to spread the concept of it.

2.2.3 Customers

The purpose of a business is to create customers (Drucker, 1973). The customers have been mentioned in the previous section 2.1 while investigating the regularly occurring pieces of a business model, and identifying the customer appears to be crucial (Teece, 2010). Further, creating customer demand internationally is one of the main responsibilities of the management team in an international new venture Oviatt and McDougall, 1994. Analyzing customers can also help understand the value of a firm (Lewis, 2006), stressing the importance of investigating them further in the context of scale-up companies, technology innovations, and autonomous road mobility. The following discussion will involve perspectives of the customers that may affect the scaling process, for example, technology adoption curve, crossing the chasm, market knowledge, and customer acquisition.

2.2.3.1 Adoption Curve and Crossing the Chasm

The commercialization process of a new innovation is a critical point in time for companies working with technology innovations. Rogers (2010) explains the diffusion process of an innovation as a process where uncertainty is reduced by communication and information sharing within a social system. Further, to explain the innovation adoption curve, Rogers (2010) presents six different types of adopter categories who are separated by their rate of innovativeness. The rate of innovativeness is explained by early or late innovation-decision, how fast a customer is moving through the list explained above. The five adoption categories are innovator, early adopter, early majority, late majority, and laggards. (Rogers, 2010).

The technology adoption curve explains when the aforementioned adoption categories of the market will adopt the new technology. A market is defined as a set of potential or actual customers (Moore and McKenna, 1999). The geographical location of the business might also affect the characteristics of the customers. Economic and political influences impact for example customers' willingness-to-pay and might therefore influence the success of the company (Cantamessa, Gatteschi, Perboli, and Rosano, 2018). Further, the adoption categories have different characteristics and needs, and moving between the categories always poses a challenge. Moore and McKenna (1999) argues that there is a particularly big chasm in the adoption curve between the two adoption categories early adopters and early majority, see figure

2.2. The chasm is a cause of significantly different customer characteristics and can create severe damage to companies who fail to cross it, as the company risks not being able to cater to any of the categories if trying to focus on both at the same time. The early adopters are fairly easy to acquire as they are prone to adopt new technologies. However, the early majority segment is significantly bigger and access is often needed to become profitable. The early majority customers are not as willing to take risks as the early adopters, and therefore prefer to buy from market leaders and seek positive reviews from trusted parties before adoption. To be able to reach the early majority Moore and McKenna (1999) suggest focusing on a single market, win domination over it, and use it as a springboard to avoid being trapped in the chasm between the customer segments. The initial marketing approach needs to change to reach the early majority, mainstream, customers as their preferences are different than the early adopters. (Moore and McKenna, 1999).

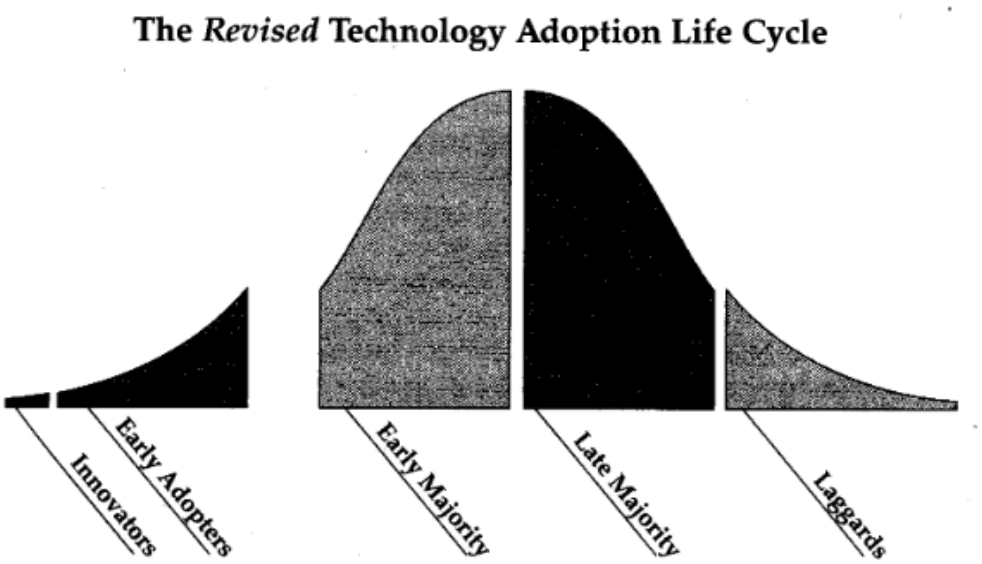

Figure 2.2: From "Crossing the chasm" by Moore, Geoffrey A and McKenna, Regis, 1999, Capstone Oxford.

2.2.3.2 The Influence of Customer Needs on Technology Innovation

Technology push is when the innovation process initiates with internal or external research and then the process of finding a market for the new know-how starts (Brem and Voigt, 2009). This way of innovating puts customers' needs aside. Similarly, Bower and Christensen (1995) theory of disruptive technologies is similarly neglecting current customers' needs when developing a new technology. Bower and Christensen (1995) means that incumbent companies often are blinded by having their main focus on existing customers and therefore risk missing new technologies. The incumbents get disrupted by new firms entering the market who manages to commercialize the new technology in insignificant or emerging markets, as the disruptive technologies do not initially satisfy the needs of the mainstream customers.

A firm that aims to disrupt a market should therefore not initially listen to the mainstream customers in that market, in line with Bower and Christensen (1995). Although, Danneels (2004) stresses that the firm is still customer-oriented, but does not only focus on serving the current customers.

There is a risk of not reaching the mainstream customers, as pointed out by Danneels (2004) in the context of disruptive technologies. To succeed with the commercialization companies must demonstrate their clear advantage over the existing solutions on the market. Firms that focus on satisfying the needs of mainstreams customers are more likely to develop incremental innovations. On the other end, firms that focus on satisfying the needs of the innovators and early adopters are more likely to develop disruptive innovations. (Slater and Mohr, 2006). The process of getting a new idea or innovation adopted by customers can be difficult, even though the innovation clearly has advantages compared to the previous solution on the market.

2.2.3.3 Driving Markets

Companies working with novel technology innovations may need to influence the market to spread the concept of the new technology. Jaworski, Kohli, and Sahay (2000) present two ways of managing a market. The term "market driven" means acceptance of the current market structure and behavior. Firms are market-driven when they learn, understand, and respond to existing behaviors and stakeholders within the given market structure. The term "driving markets" is explained as influencing the behaviors of the players on the market or the structure of the market to improve the competitive position of the company. Jaworski et al., 2000 describe three different approaches for a company to drive the market. The first one is deconstruction by eliminating players in the market. Second one, construction meaning building a new market structure, and lastly functional modification, changing the current functions performed by the players.

2.2.3.4 Market Education

Market education is another aspect within the customer factor that arguably affects the scaling process. Stampfl et al. (2013) present the market as a moderating factor for business model scalability and include market knowledge. The concept of market education is especially interesting when introducing a new innovation to the market as this means that the customer has little or no previous knowledge about it. According to Stampfl et al. (2013), the lack of knowledge can inhibit the scaling process. Increasing the familiarity of the innovation among customers will enhance the scaling process (Stampfl et al., 2013). Apart from educating customers as a group, the use of internal change agents could help drive change at customer companies towards acceptance of the new technology. To overcome resistance and disputes an employee with power, is beneficial (Buchanan and Badham, 1999), as change agents efficiently implement change by defying standardized processes in an organization (Wickenberg, 2013). Additionally, Adner (2006) states that sometimes it is valuable to delay the development process to let other players, like customers or regulators, catch up.

One way to increase customer knowledge is through branding, which has become increasingly important for startups, especially international startups, to be able to succeed in the market. Branding should go beyond the visual brand identity, including for instance vision and culture, to draw attention to the company. (Konecnik R and Ruzzier, 2015). In addition, Konecnik R and Ruzzier (2015) argues that for startups the brand evolves symbiotically with the iterative development of the company, attracting new customer segments. Grant (2016) agrees that brands are an important source of competitive advantage and that the brand needs to be durable, otherwise the value erodes over time. As a brand is an intangible asset, it is harder to replicate, which is also a determinant of a sustainable competitive advantage (Grant, 2016).

2.2.3.5 Adoption of Autonomous Road Mobility

The mindset and attitudes of people affect how quickly a new innovation is adopted. Through a study, it is concluded that the attitude towards autonomous road mobility follows the pattern of general adoption to new innovations. (Liljamo, Liimatainen, and Pöllänen, 2018). Shabanpour, Mousavi, Golshani, Auld, and Mohammadian (2017) found that the customer adoption behavior of autonomous road mobility is affected by demographics, experience with technology, driving patterns, and expectations on the technology. The adoption category that currently views autonomous road mobility most positively is early adopters. Further, the study shows that ethical perspectives and road traffic safety is key factors in the acceptance process of autonomous road mobility. (Liljamo et al., 2018). Further, Simpson, Mishra, Talebian, and Golias (2019) present a model to estimate the future adoption of ATs by freight transportation organizations, which we think is possible to generalize for the whole area of autonomous road mobility. Simpson et al. (2019) suggest a market penetration rate varying from 20% to 95% within 25 years, implying that the future of autonomous road mobility is still highly uncertain. The variation depends on three main factors the improvement of autonomous technology over time, the addition of external factors that influence (as marketing and price), and changes in public opinion on the autonomous technology. (Simpson et al., 2019). Further Simpson et al. (2019) stresses the need for more research in the area of organizational innovation adoption behavior.

2.2.4 Teams

The sheer size of the theoretical field around organizational theory and the abundance of organizational challenges that firms encounter during their lifetime makes it impossible to cover them in this thesis. Instead, the topic of teams was through literature review found to be especially important for firms transitioning into scale, which is why it is focused on here.

2.2.4.1 Organizational Structure

At some point, the informal structure of a start-up is not sufficient to bring the company forward. A more organized structure is needed to handle internal issues, daily operations, and facilitate the required speed of decision-making. All of this strains the organizational structure. According to Davila, Foster, and Jia (2010), the threshold lies somewhere 50-80 employees, as the number of relationships within the company increases at a faster pace than the number of employees (Kotter and Sathe, 1978. The challenges connected to leadership grow with the size of the company (Harnish, 2014). Increased complexity is exponentially related to the growth of a firm, and the firm needs to transform from an ad hoc, spontaneous entrepreneurship to a professionally managed entrepreneurial firm with set goals and plans (Flamholtz and Randle, 2007). Managers and employees of start-ups often have a hard time understanding the enlarged complexity and are reluctant to employ a more formal infrastructure (Sutton and Rao, 2014). This as they view structures and processes as the fastest way to bureaucracy and to slow down the company. Davila et al. (2010) claim that the chaos of not properly structuring a company can do even more harm than bureaucracy. In fact, Flamholtz and Randle (2007) claim, it is the lack of required infrastructure that causes chaos. Davila et al. (2010) further imply that structure not automatically suffocates entrepreneurship. Another common critique of formal structure is that it creates hierarchies, which increases the probability of bureaucracy. These, however, help create order, predictability and coordination. (Sutton and Rao, 2014). These hierarchies can also make it easier for the manager to delegate responsibility and decision-making power, which otherwise severely can obstruct growth (Flamholtz and Randle, 2007). The increased complexity that comes with scaling a company can sometimes be fatal (Harnish, 2014). To overcome this it is important to understand that scaling a company does not necessarily imply that everything needs to be scaled up. To scale successfully, it is equally important to decide what should be scaled down and to pause the scaling eventually to give room for reflection (Sutton and Rao, 2014).

2.2.4.2 The Importance of Building a High-performing Team

According to Sutton and Rao (2014), scale-up companies experience challenges regarding human resources, and how these are handled arguably defines if scaling can be sustained. As the success of the company grows, so do the activities and the need to recruit employees. Attracting people can be challenging for small firms as they lack resources (Kotter and Sathe, 1978). They often have a hard time reaching out to experienced people that are valuable for future success as they have little to offer in terms of reputation and security (Bhide, 2000). In contrast, scale-ups can offer non-monetary advantages like personal development, career advancement (Kotter and Sathe, 1978), and remunerations like stock options or partial ownership ("5 Challenges of hiring as a startup", 2020). Mathews (2012) states that working in a young newly started company means being in an environment where things constantly change. Being a part of such a company means that employees need to embrace the culture and adopt a future-oriented and forward-thinking perspective. According to Sutton and Rao (2014), the most important part, however, is not to

find the most skilled people, but to build a team that is diverse, works well together, and spurs everyone to perform at their top level. In a small company where everyone is directly impacting the success of the company, each hire becomes critical. Especially as each new hire can affect the configuration of the team and the company culture. It is further important to hire strategically, the right person at the right time, to keep talents. (Kotter and Sathe, 1978). The risk of hiring someone long before their competence is needed is that they might resign, losing all the effort that was spent on the recruitment. ("5 Challenges of hiring as a startup", 2020). Additionally, scale-ups often need to hire many people in a short period of time, and onboarding with training and assimilation with company culture becomes difficult (Kotter and Sathe, 1978).

As the company grows, the competencies needed shift, and thereby the roles of the employees. Initially, the company works in a way that is not possible to scale (Graham, 2013), however, over time, these working methods need to change, which might require different skills. Additionally, the roles and responsibilities change due to the size and scope of the firm, and many struggle with adjusting to such change (Kotter and Sathe, 1978. Another challenge highlighted by Flamholtz and Randle (2007) is turning early-hire technical specialists into managers over a team of new employees. This creates tensions for the individual in transitioning from hands-on tasks and control over details to gaining an overview, act as support for team members, and delegating authority and control (Flamholtz and Randle, 2007).

Flamholtz and Randle (2007) further highlight the importance of structuring roles and responsibilities as the team grows. If employees do not understand their role and their part in the team, the risk for duplication of work or the loss of work that does not fall under anyone's responsibility increases (Flamholtz and Randle, 2007). The way employees and teams can be organized in an organization differs vastly and can range from extreme specialization to everyone doing everything. Adam Smith argued already in 1791 that total division of labour would increase efficiency and output significantly as the employees were able to become incredibly skilled at one task. On the contrary, the employees only knew that one task, which decreases flexibility and understanding for the whole picture (Smith, 1791). A less extreme version of specialization of work is a functional or product departmentalization, where activities of the company are grouped according to specific functions or products, still letting employees become skilled in a specific area. The disadvantages of specialization of work are that employees have difficulties understanding other departments and risk working in silos where communication and alignment between the departments are lacking, and thereby complicate work. A cross-functional structure, where employees and work across functions and products, help solve the above problems. However, thereby the functional knowledge is depleted. (Slack, Chambers, and Johnston, 2010).

3
Methodology

In the following chapter, the research method of the thesis will be described and discussed. Further, the case company will be presented and ethical aspects of the research.

3.1 Research Approach and Design

The chosen method for this thesis is a qualitative method with an abductive approach. The abductive approach is a mix between an inductive and deductive approach (Dalen, 2015). A theoretical framework initialized the thesis and as interviews were conducted, complementary literature was added, meaning that the thesis is not of a purely inductive nature (Bryman and Bell, 2014). Nor is the thesis of solely deductive nature as no hypothesis was stated initially (Taylor, Bogdan, and DeVault, 2016).

The research design is a single-case study of a company described in section 3.2.2 Case Company. The case company gives depth to research and serves as a valuable resource for a thorough understanding of the issue. Denscombe (2018) highlights the appropriability of doing a case study when investigating a subject in depth which supports the proposed research strategy. The research question concerning business model scalability for scale-up companies working with technology innovations in autonomous road mobility has, of our knowledge, not been examined before. This implies that doing a case study is suitable for connecting the current literature within scaling, business models and technology innovations with practical knowledge from an actual scale-up company working with autonomous road mobility and through this contribute to research.

3.2 Research Methodology

The study is of a qualitative nature and qualitative interviews were used for data collection. Interviews are used over for example surveys since it gives the respondent a possibility to elaborate and give a nuanced answer (Bryman and Bell, 2011). The possibility to give this type of answer supports interviews as a data collection method, as the objective was to understand the effect of the factors on international business model scalability. To get a holistic view of the company context and different perspectives on the four factors the interview pool included a range of different respondents.

3.2.1 Theoretical Framework

The theoretical framework served the purpose of giving a solid ground of research to base the thesis on, while also providing background knowledge and understanding. A range of different literary sources was used, for example, academic journals, governmental reports, conference papers, laws, and books. The search for relevant literature was based on specific keywords, such as "internationalization", "scaling", "business models","business model scalability", "autonomous vehicle", "autonomous mobility", "sustainable transportation". Further, the search included backwards chaining from references considered as specifically relevant and trustworthy, partially based on the number of citations. Additional relevant literature was suggested by professors within the field of innovation and entrepreneurship at Chalmers University.

The reviewed literature was firstly focused on gaining general knowledge within scalability, internationalization, scale-ups and autonomous road mobility. Secondly, the literature reviewed had its focus on providing knowledge about the factors legal framework, complementary technologies, customers, and teams. After the interviews were conducted further literature was reviewed to cover new aspects that were highlighted in the interviews. The selection of the mentioned factors was made with the basis in existing literature, and it was confirmed these were recognizable at the case company through five initial informal talks with employees at different departments.

3.2.2 Case Company

A suitable company has been identified to be able to research this topic and gain empirical understanding. The case company has been growing rapidly the last couple of years, from less than 10 employees in 2017 to between 100-150 employees in 2021. The company thereby fits the used definition of a scale-up, with more than 100 employees, growing employment by more than 20% annually. The company's business model includes two distinct but interrelated products within the same offer; an autonomous electric vehicle along with a digital platform. The purpose of the platform is to facilitate both a marketplace for autonomous electric transport, as well as management of the autonomous vehicles. The company tries to solve the aforementioned technical issues of autonomous road mobility. With that being said, the autonomous vehicle and the platform enable each other, meaning that they are mutually reliant on each other's existence. The platform cannot function without having vehicles to offer in the marketplace. Further, the autonomous vehicle cannot be used without a tool to manage it, which is one of the functions within the platform. The platform is in use today in pilot testing of the autonomous vehicles with customers. The term "Complementary Technologies" is applicable to the combined offer of the platform and the autonomous vehicle.

Although the company is working with autonomous electric vehicles, this thesis will only consider the autonomous context. Keeping the focus on both the electric and autonomous context in connection is viewed as a too narrow scope. The company is currently also offering transport with regular electric vehicles to generate revenue,

however, this will neither be focused on in this thesis.

From mostly focusing on technology development and finding a way for their vision, the company is now trying to prove the feasibility of its business model by developing solutions together with their first customers. The company is today mainly financed by external capital and to secure the next rounds of investments they need to prove that they are able to scale the business and start generating more recurring revenue. The case company has a way of working to create new customer leads within their home market, but believe that they soon will need to expand abroad. Both to demonstrate to investors that the potential market size is significant, as well as to gain traction internationally to secure market share and future revenue.

3.2.3 Interviews

The main data collection method was interviews and these created the empirical data of the thesis. The interviews were semi-structured as it allowed for structure and predefined questions as well as adapting the interview to the respondent's answers (Bryman and Bell, 2011). This approach was suitable, as to understand the bigger picture and the effects of the factors clarifying follow-up questions were sometimes needed. Four different interview templates, one per factor, was used (see Appendix E Interview Questions for details). The factor-specific templates included both in-depth questions regarding the factor of interest, but also a few questions regarding the three other factors. The template was approved by the supervisor at the case company to be sure that the employees would be able to understand. The template used for each respondent was chosen based on their area of work, and if they had any other specific knowledge. These templates were then customized to each specific interview. Before the interviews, an explanation of the thesis, key concepts and the interview structure was sent to the respondent to allow for preparation.

The interview pool consisted of 18 people from six different departments of the case company to get a comprehensive view of the issue. There is no defined number of needed interviews to reach saturation in a single-case study, but an indication could be the suggestion of 16-24 interviews to gain a deeper understanding of a subject (Hennink, Kaiser, and Marconi, 2017). The first suitable respondents were given by the supervisor at the company upon request to interview employees that would be able to answer the questions. At the end of each interview, the respondent was asked to suggest colleagues that were knowledgeable about the topics. The employees that were mentioned frequently were interviewed, and the interview process ended when most employees mentioned already were interviewed.

All interviews, apart from two, were conducted online through video conference calls due to sanitary restrictions related to COVID-19. Both researchers attended all interviews. Notes were taken during the interviews to be able to go through the interview directly afterwards and collect initial thoughts. Most interviews were recorded and, to fully be able to analyze the collected data, later transcribed by transcribing every word, but excluding pauses and filler words. Only using notes

results in data reduction, both due to unconscious and conscious bias of what is of importance (Lantz, 2007). The advantage of being able to transcribe interviews was weighed against the disadvantage of recordings. According to research, respondents are more likely to angle their answers to their own advantage and hesitate to talk about sensitive issues when recorded (Jacobssen, 1993). Therefore, the recording was optional for the respondents, although the questions were mainly not of sensitive character.

Table 3.1 Summary of Conducted Interviews includes information regarding each interview. The roles of the respondents are general paraphrases of their actual titles. The teams are also adapted to simplify. The respondents working directly with technology are divided into the Platform Team and the Autonomous Vehicle (AV) Team according to their main responsibilities. In chapter 4 Results the opinions and statements made by the respondents will only be related to a specific team due to confidentiality restrictions and to increase the anonymity of the respondents. This does not affect the quality of the analysis.

Table 3.1: Summary of Conducted Interviews

Respondent	**Team**	**Factor**	**Time**	**Recorded**
HR Manager	HR	Team	30	yes
HR Generalist	HR	Team	30	yes
HR Recruiting	HR	Team	30	no
Product Manager	Platform	Tech	30	yes
Chief Software Architect	Platform	Tech	30	yes
Business Developer	Commercial	Customer	30	yes
VP Sales	Commercial	Customer	30	yes
Sales Developer	Commercial	Customer	30	yes
VP Engineering	AV	Tech	30	yes
Founding Engineer	AV	Tech+Legal	45	yes
Autonomous Drive Engineer	AV	Tech	30	yes
Chief Automotive Architect	AV	Tech+Legal	30	yes
Development Engineer	AV	Tech+Customer	30	yes
System Engineer	AV	Tech+Legal	40	yes
General Counsel	Legal	Legal	30	yes
Project Manager	Operations	Customer+Legal +Tech	45	yes
Chief Operating Officer	Operations	Customer	30	yes

3.3 Data Analysis

Interviews were analyzed using qualitative content analysis. The intent of the content analysis is to systematically arrange the collected data to be able to draw realistic and representative conclusions from it (Bengtsson, 2016). The process uses

created text from interviews as a base for identifying recurring themes and groups them together (Bengtsson, 2016). To do this, a coding methodology was used. Coding is the way data is defined by identifying a section of text that relates to the main research topic and how it links to other data (Gibbs, 2018). The codes were built based on the data, which implies an inductive coding method (Christians and Carey, 1989). The respondent's responses were reviewed after the interviews were completed to construct a set of codes related to each factor. Below a chronological description of the steps taken in the analysis is presented.

Step 1
Initial review of the transcribed interviews was done individually by the researchers. Simultaneously, quotes were highlighted based on relevancy for the research question.

Step 2
In vivo codes were invented based on the data. First-order grouping of codes was conducted based on the four previously identified factors.

Step 3
Quotes were coded in vivo. Initial coding was done by both researchers to ensure a common understanding. Subsequent coding was done individually by the researchers and eventually reviewed again by both.

Step 4
Quotes were divided by codes and put in separate documents. The codes were described based on the quotes and related to the research question. To ensure data quality, some quotes were left out.

Step 5
Second-order grouping of codes within each factor was conducted based on the affinity of quotes.

Step 6
Relationships between different groups of codes were drawn as well as relationships to theory for analysis.

3.4 Methodology Discussion

The following section contains a discussion of the methodology of this thesis.

3.4.1 Validity, Generalizability, and Reliability

The contribution to theory is highly dependent on if the results of the thesis are believable. Validity, generalizability, and reliability are criteria to be met and they are respectively evaluating whether the research investigates what it intended, if results can be applied to other settings, and are consistent and reproducible (Easterby-Smith, Thorpe, and Jackson, 2015). The factors were partly chosen with the inten-

tion to make the research as applicable as possible to other situations and companies apart from the case company. Using coding as a method of analysis increases validity for the analysis as it grants structure to the data so that it is possible to systematically go through it. Coding also increases validity as it enables the researcher to appraise if the analysis represents the respondents, avoiding over-representing one respondent or department. Furthermore, coding enables transparency as it permits other researchers to review the work which enhances reliability. As the interviews were read through and codified by the two researchers separately, high inter-rater reliability was established as the researchers agreed on codes. This established consistency in the coding system. A common critique of single-case studies is the lack of representativeness. By investigating a specific case it can be difficult to generalize to other contexts as it might over-emphasize issues especially important to the specific case, or miss other issues that seem unimportant. However, as the complex nature of the issue investigated is scrutinized, readers are able to learn from the case study and determine what can be transferred to another situation. (Erickson, 1986).

3.4.2 Risks With Research Method

The following discussion is made with the purpose to highlight the risks and measures taken to mitigate the severeness of their impact. There are risks that the thesis will not be as believable as anticipated.

As interviews at one specific case company were conducted there is a risk of this data being biased or non-representative and thereby skewing results. Further, as the researchers have a rather similar academic background and may have a perception of the issue in advance of the start of the thesis there is a risk of them being biased as well. A mitigating factor to this is that the researchers have different experiences where one of them has previous professional knowledge about the case company. Through transcribing the interviews initial bias was mitigated as the full interview could be analyzed. Further, using qualitative content analysis and coding it is easier to become aware of potential biases in the analysis.

3.5 Research Ethics

Conducting a thesis as this one needs to consider ethical aspects that may be affected by either the realization of the research method or the result of the thesis. Generally, to follow research ethics, the thesis should be conducted in a manner where participation is based on informed consent and is voluntary, researchers protect the participants' interest, operates and complies with the laws of the country, and with scientific integrity (Denscombe, 2018).

The mentioned aspects of research ethics were of careful consideration when the interviews were conducted. The respondents were treated with respect and their interest is protected. An example of this was that all respondents were asked if they were comfortable with recording the interview. Further, as some sensitive and confidential information from the case company was brought up it is of utmost im-

portance that this information is handled carefully and before publication, the thesis was reviewed by the company supervisor.

Another important aspect concerning the societal-ethical impact of this thesis is the contingent shift towards autonomous road mobility and its impact on human resources. If companies within the autonomous road mobility sector overcome issues regarding scaling, a shift in demand regarding competence will arguably happen. Jobs like driving trucks and cars will no longer be needed to the same extent, although a new profession of remote driving will appear. Furthermore, there is a current lack of drivers, especially truck drivers in the market today, and remote drivers could solve this problem as one person can handle several autonomous vehicles. Additionally, there will be an increase in demand for engineers.

The purpose of the thesis is to map how certain factors can facilitate the international scaling process of companies working with autonomous road mobility. If this purpose is fulfilled there is a possibility that the implementation and adoption rate of the new technology increases. This in turn may speed up the aforementioned industry shift of competencies and demand of human resources, which will impact the greater economy and specific personal lives.

4
Results

The results of the thesis were divided into the four factors legal frameworks, complementary technology, customers, and teams. This chapter is a synthesis of the findings from the interviews, illustrated with selected quotes by the respondents that describe their views on how the factors affect the scalability of the case company. Each factor was divided into smaller fractions called subfactors based on the codes used to analyze the interviews, and this division is further used for structure throughout the Results chapter. A summary of the four factors and the associated subfactors, 14 in total, are illustrated in Table 4.1 below.

Table 4.1: Interview Results, subfactors per factor

Factor	**Subfactor**
Legal Frameworks	• Lack of Alignment Between Legislation and Technology • International Legal Inconsistency • Lobby Work
Complementary Technology	• Complementary Technologies Enable Each Other • Long-term Vision with Dual Focus • Technical Readiness
Customers	• Adoption Curve • Brand Recognition • Customer Education • Existing Market Structure
Teams	• Talent Management • Locate Experienced People with a Scale-up Mindset • Integration of New Employees and Teams • Coordination of Working Tasks

4.1 Legal Frameworks

Empirical data showed three particularly relevant aspects to legal frameworks; Lack of Alignment Between Legislation and Technology, International Legal Inconsistency, and Lobby Work.

4.1.1 Lack of Alignment Between Legislation and Technology

Legislation is known to develop at a slower pace than technology development and the Lack of Alignment of Legislation and Technology is referring to the gap between how legislation is applied and what is needed to facilitate the commercialization of the new technology. At the moment the lack of applicability and confusion over the interpretation of current legislation is complicating the application of autonomous road mobility. This is highlighted by a respondent from the Legal Team stating *"Legislation has not had what we are doing in mind, that there will be vehicles without drivers. That is the biggest challenge"*. Several of the respondents mention the fact that legislation requires a human driver in the vehicle as to the main challenge. Respondents from the AV Team concertized this as *"There is a lot of focus put on that the driver always has been the road user because that person is at the location. But if we are not at the location, then we are not the road user. So the legislation which concerns the road user, referring to the driver, makes things a bit strange for us"* and *"According to the law you still need to be able to be tested for drunk driving, set up a warning triangle, etc. That is why a self-driving vehicle is not compatible with existing laws"*.

Due to the lag between legislation and technology, companies working with autonomous road mobility have limited regulations to base their technical choices on. A respondent from the AV Team explained that *"If you have a bunch of vehicles that are exempt of type approval, and then suddenly there are laws in place, our vehicles will most probably not meet those regulations without having to be reworked"*. This implies that prioritization of functionality according to different legal requirements that arise becomes more difficult, and it increases the uncertainty of what exactly can be done with customers. A respondent from the Operations Team extends the problems of commercialization by saying *"Laws and regulations need to be further ahead for this to be a ready product or service that can be offered to customers"*.

To overcome these issues, companies can apply for trial permits from the Swedish Transport Agency "Transportstyrelsen" that allows driving vehicles that not comply with current legislation on public roads. Respondents from the AV Team explained that a new permit is needed for each new location, which is becoming a bottleneck, both for the company and Transportstyrelsen, as the process is not adapted to have several permits. A further issue was raised by one respondent from the same team stating that *"Because we need trial permits for each road and trail makes this about trial activities, and no real commercial operations"*.

Apart from the lack of alignment between legislation and technology, there seems to be confusion on how to apply current legislation and a lack of distinct legislation that classifies autonomous vehicles. A respondent from the AV Team said that *"In the beginning of this year [2021] Sweden launched new legislation that would facilitate driving vehicles without human drivers. [...]. We asked Transportstyrelsen how they viewed the legislation, and they said that it makes no difference"*. About the new legislation, another team member agreed that *"It seems like the government did not write it accurately. They created new rules, but then the authorities interpret them in the same way as before. That is why what the government tried to do has not come into force"*. The same respondent further highlighted the fact that the lack of classification sends them back and forth between different authorities when asking for directions and permits, as the authorities seem to have difficulties understanding how to apply the legislation. Important to point out is that it is mainly the autonomous vehicle that is held back by legislation, it provides no obstacle for the platform, which was confirmed by a respondent from the Platform Team.

4.1.2 International Legal Inconsistency

International Legal Inconsistency refers to differences in legislation between countries. The area of autonomous road mobility is novel and there are few common principles around the world on how to handle the phenomenon. The fragmentation of legislation increases the difficulties to commercialize autonomous road mobility as the company needs to conform to disparities in legislation. A respondent from the AV-team said that *"It is up to the countries to listen to different [governmental] bodies, and there is quite a lot of heritage [around who to listen to]"*. Respondents see such differences in legislation as an obstacle to scaling, and highlighted by the Legal Team was that operations, in general, would get a lot easier if there was common legislation. A respondent from the AV Team agreed and linked the international differences to permit processes: *"I have a hard time seeing advantages with different legislation. It would be incredibly good if there was one permit process for all of Europe"*. These responses highlight the advantages of having higher-level legislation of international scope, set by for instance the EU or UN. There are however some disadvantages, that also would positively speak for low-level legislation nationally. A respondent from the Legal Team pointed out that *"Things are slower at a higher level, it takes more time to change"* and suggests that it may be harder for a single player to affect the legislator's decisions. In addition, the same respondent also highlighted that *"The advantage with local legislation is that it can be more beneficial in some countries"*. National legislation that is less restricted creates local opportunities that a more restrictive common legislation would hinder. Anyhow, a respondent from the AV Team said regarding national and international legislation that common international legislation would be both beneficial and likely in the relatively foreseeable future, and that the company, therefore, needs to be responsive to the legislative development abroad to be able to conform to legislation to facilitate international operations.

4.1.3 Lobby Work

Due to the novelty of autonomous road mobility, the general knowledge about it is limited among legislators. Lobby Work refers to how the case company can influence legislators to decide about more accurate laws regarding the application of autonomous road mobility. It is proposed by the respondents that the case company should act proactively to help legislators understand the new technology by showcasing their product. A respondent from the AV Team said that *"It is almost our responsibility to help the authorities to understand how the legal framework should look like. [...]. We cannot expect such legal frameworks to appear without the involvement of the industry, it is so new that no one understands until one has seen autonomous vehicles"*. The respondent from the Legal Team agreed saying that *"It is important from our side to show that this is something that is happening now and that change is inevitable"*. The company should, according to the respondents, take an active role in discussing the current law with authorities to suggest a solution on how it can be applied to this new situation. They further suggested that exploring applications of autonomous road mobility together with Transportstyrelsen would be beneficial. Another respondent from the AV Team explained that *"They [the legislators] want to listen to what the industry thinks. Therefore it is important that the industry actually takes the lead and not just sit around and wait until things are ready and are profitable"*. It is not only the contact with legislators and Transportstyrelsen that is important. Respondents from both the Operations Team and the AV Team highlighted the importance of spreading information and gain acceptance by the rest of the industry to establish valuable contacts and gain allies. However, this kind of lobby work takes a lot of time according to a member of the AV Team. It further requires a level of technical development to be able to use a proof of concept as an argument, which a respondent from the Legal Team advocated by stating *"I think that we need to try to influence external decision-makers [...] by showing them our offering"*.

4.2 Complementary Technologies

Empirical data showed three particularly relevant aspects to complementary technologies; Complementary Technologies Enable Each Other, Long-term Vision with Dual Focus, and Technical Readiness. The findings are presented by quoting different respondents from the interviews.

4.2.1 Complementary Technologies Enable Each Other

The subfactor Complementary Technologies Enable Each Other is referring to how the platform and the AV enable each others' existence. A distinct role of the AVs today is to bring in customer and therefore enabling the platform. The platform, being in active use today, creates customer data and revenue, and kick-starts the implementation of the offer with the customers. Therefore, there is a duality in offering both a platform and autonomous road mobility to the customer. From the interviews, it was clear that the combination of these two is what creates the most

value as they seem to enhance each other's performance.

AV
Today the role of the AVs is mainly about bringing in customers to the company which enables the use of the platform. When the AVs are used commercially, the more AVs available in the platform the more attractive the platform becomes. This is highlighted by a respondent in the Operations Team *"The more AVs registered in the platform the more strength it generates in the whole system, better optimization, higher efficiency"*. The platform will not be as valuable for the customers without the integration of AVs. The data generated from the AVs will also increase the strength of the platform and help the case company to become more efficient at delivering cheaper and sustainable autonomous transport.

Platform
On the other side of the duality, the platform enables the usage of the AVs, as stated by a respondent from the AV Team *"If it is to be possible to drive the AVs at all, you need the platform"*. The platform is essential for managing and controlling the AV. Today, the platform is used as a first step on the customers' journey towards implementing AVs. This allows the case company to help the customers to become prepared for the AV implementation. A respondent from the AV Team said that *"If we only would offer the AV, then all the customers' IT systems would be too underdeveloped"*. By having the platform in use, it collects data and information about the customers. This allows for incremental optimization of the platform and the ability to use the data for further development of the AV.

Furthermore, the platform enables the AVs by extending the development process, as stated by a respondent from the AV Team, *"I think we buy some time with the customers, allowing us to wait for the technical development of AVs to get up to speed. Then we will be able to deliver the AV to the customers when they have found interest in the company and been integrated with the platform"*. This means that while the AV technology is developed the integration of the total offer and the needed transformation of the customers' system has already started through the implementation of the platform. A respondent from the AV Team highlighted the financial importance of having the platform in use already today *"And then the platform will also make sure that, for us to be able to grow as a company, then we need to make sure that we earn money in some way"*. In connection to the scenario of not offering the platform at all it was stated that the company probably would not survive until the AV is ready, *"Our company would have been too small and we would have had too few investors that support us to survive as long as needed for the development of the AV technology"*. The revenue aspect seems to affect the prioritization of business units, as well as international expansion, as the ability to charge customers for services is important. Thus, it is obvious that the platform is important and enables the AV in several ways.

Several respondents at the case company highlighted the importance of offering both technologies and stated that they enable each other. For instance, a respondent

from the AV Team said *"The platform and the autonomous vehicle are important components for what we want to achieve"*, and further stated that *"The AV and the platform enable each other during the whole journey"*. Another respondent from the same team stated *"And I do not think that the company would have done so well without either the platform or the AV"*.

4.2.2 Long-term Vision With Dual Focus

The interviews showed the importance of having a long-term vision to reach future success. The long-term strategical decisions need to take the duality of the complementary technologies into account, otherwise risking to over-or underinvest in either. Further complicating the decision-making is that long-term decision may seem non-logical short-term. Respondents from the AV Team stated *"Our strategic leaders look very far into the future with a high ambition level"* and *"When I work I look at the very short-term stuff but also the very long-term, and I know where I want us to end up"*.

The duality in the long-term vision brings complexity in making long-term decisions, regarding both directions of development and development pace. There is a need to sync the two development processes with each other, highlighted by a respondent in the AV Team *"If we work in one way with the platform without anchoring it with how we work with the AV, then we risk them sliding apart"*. Long-term vision further seems to affect the development pace of the platform and the AVs. It is important to not over- nor underinvest, but to ensure capabilities and market advantage to claim a good future market position. As highlighted by a respondent in the AV Team *"If we overinvest in autonomous development there is a risk of not being able to invest enough in the current offer. If we underinvest in the autonomous development and only focus on the current offer then we might be extremely successful 5 years ahead but then companies who invest in AVs now will outcompete us"*. Another respondent in the same team exemplified the difficult situation of overinvesting in technology before the surroundings were ready by telling a story about a bankrupt company called Starsky Robotics, *"They [Starsky Robotics] were a company manufacturing self-driving trucks. They built a fleet of about 100 trucks, but the problem was that the startup pulled on a lot of costs, and the technology wasn't really where they wanted it to be. So they started to get an enormous drag on their revenue. This led to them running out of money and going bankrupt. That is the risk of scaling before you understand the amount of maintenance needed. But startups always need to take risks. And this is a risk I see, we can self-destruct this company"*. Another aspect within the issue of having a long-term vision is the choices that are logical for tomorrow, might not make sense for the customer of today, which makes it a balancing act. Highlighted by a respondent in the Platform Team *"If the customers we have right now does not match our "ideal" customer, then it might be stupid to base the development on the ideal customer"*.

It is important to develop the platform and the AV simultaneously, both to synchronize them, but also as they can not expect that other actors will be ready in

time to support either one of them. As stated by a respondent in the AV Team *"We develop something now that is not profitable today but it puts us in a very good position for tomorrow. When the AV technology is mature enough for society then we do not need to start from the beginning"*. Another respondent in the same team further highlighted the long-term goals of the AVs *"We do not hope to earn the big money on the AV in the most present years, it is rather about open a lot of doors, and creating a market as there is no market yet"*. The long-term vision includes creating new markets and already now building relationships with governmental bodies to be able to impact the legal development and develop the technology in line with it. An example of an effort that needs to be done today although generate value long-term was highlighted by a respondent in the AV Team *"It is a long-term process of building trust with Transportstyrelsen etc. so we can not start with that later"*.

A standardized way of working allows for greater flexibility with company resources. This in regards to both the features of the products and making sure the platform and the AV are technically synced, but also regarding internal working methods, like writing all code in the same language to be able to move employees around. A respondent in the Platform Team said *"One thing that I work on right now is to be able to move resources from the AV to the platform, they have the same way of working, technologies and principles"*. Additionally, raised by a respondent in the AV Team, technical choices are also related to what partners to work with, to ensure that the partner companies are robust enough to survive long-term and are flexible and rapid to not hold the company back.

Resource allocation is another important question while having a dual focus in the long-term vision. It can be troublesome as trade-offs and potential competition of resources between the two technologies may appear. A person from the Platform Team highlighted this, *"Of course there are trade-offs, there is a need for software developers in both lines"*. The internal competition of resources is mostly centred around human resources, and that the same type of competence (software engineers) is needed within both the platform and the AV. Allocating hiring budgets between the teams of the platform and the AV can be tricky as experts in both fields are expensive and hard to find. Trade-offs are ever-present in scale-ups and the prioritization of resources is often based on what is most pressing at the moment.

The customers have an important role in the long-term vision as well. The platform needs enough features to satisfy current customers so that they do not opt-out before the AV is ready. The AV in turn needs enough features to drive customers, and to be sure they do not fall behind other actors in terms of technical development. A respondent from the AV Team explained this *"If we develop a few new features on the AV, then we might attract some new customers. On the other hand, if customers are brought in and we do not have enough capabilities and functions in the platform then we might not be able to get them down the funnel"*. A respondent from the Platform Team raised a further issue regarding customer involvement in long-term decisions, *"We need to collect knowledge about our customers, we need more knowledge about transportation flows in many parts of the world and in many*

markets, and we learn extremely much from having our current customers using the platform to learn about how they use vehicles". A respondent in the AV Team added that it is also important to ask the question *"What customers match with us?"* to find what type of customer to focus long-term on. A scale-up can still be on the search for their key customers, figuring out where their offer fits in by learning from current and potential customers. Identifying customers affect decisions on what features to include and helps understand how customers use the offer. When asked if the knowledge about customers affect daily work a respondent from the AV Team said *"Yes, it affects in the way that the target customers affect how we are prioritizing, or at least it should do"*.

4.2.3 Technical Readiness

There are technical challenges of developing new technology within autonomous road mobility. The technology is continuously developing, which was found to be an issue. For instance, it makes it complicated to know when it is ready enough for commercialization. Further, the duality of the offer, having one software and one hardware to scale is an interesting aspect as they seem to have different levels of scalability.

When the AV is more technically ready, the developers in the AV team will be able to transfer the management and operations of the AVs to another team, and thereby become more specialized and free up time for further development. This was highlighted by a respondent in the AV Team, *"Hopefully the data collection and evaluation will become automatic, then we do not need a tech-person [at customer location]. There needs to be a finished result on your screen without you needing to interpret the results"*.

From the interviews, it was found that there are constraints in terms of the platform, and technology depth to be built to make the technology ready for commercialization. Furthermore, the lack of technical readiness in the AVs makes it difficult to answer customer questions about how it works in specific situations when it will be able to run on public roads, the cost of operation, and safety-related questions, as stated by a respondent from the Commercial Team. A respondent in the Platform Team highlighted the hardship of operating in a novel technology area where the technology develops with time and experience. Then the company needs to be agile and adapt operations to new technological capabilities along the way. Further, it is hard to determine when the technology is ready enough to fulfil enough customer needs. A respondent from the AV Team highlighted this by saying *"You can never wait until it is completely ready because it will never be, but it is a trade-off regarding how much of the customer needs we can cover with the technology we have today"*.

The duality of the technology development makes it interesting to separate the hardware and the software when examining how the technology affects scaling as it may differ between the two. Scaling hardware is seen as a difficult task as the AVs are continuously developing and the finished vehicles need to be managed. A respon-

dent from the Platform Team highlighted that every vehicle is unique, which was further explained by a respondent from the AV Team stating that as the AVs are not fully ready for commercial use and continuously developing, continuous changes are made to it. Further, a respondent from the Platform Team raised a concern about industrializing the development of the AVs. Building a bigger vehicle fleet requires a more standardized manufacturing process which can be difficult to achieve without giving away sensitive information to other parties. Another difficulty is to uphold operations. As stated by a respondent in the AV Team *"With our current number of employees it will be challenging to have more AVs up and running in a functioning and working way"*. The AVs still need a lot of testing, and as legislation forces a person to be responsible while driving, this adds to the number of employees needed for a larger fleet. A respondent from the AV Team further emphasized, *"Testing of the vehicle is the critical factor! Everything needs thorough testing, and that requires a lot of human capital"*.

The scaling of software is believed to be easy in relation to hardware as highlighted by a respondent from the Platform Team. By adding more and more experienced people, the platform develops quickly and is possible to scale. Although, another respondent from the Platform Team said *"Other things with entering a new market means changing language, units, timezones, all those things that feel obvious now when it is so easy to get access to any website, those things are rather difficult technically"*. A respondent from the AV Team said *"Every customer has their own processes and data formats, so we need to put some time to integrate each customer successfully, to make it work smoothly for every individual customer"*. The platform is, however, not viewed as a bottleneck by a respondent from the Platform Team.

4.3 Customers

Empirical data showed four particularly relevant aspects to customers, Adoption Curve, Brand Recognition, Customer Education and Existing Market Structure. The findings are presented by quoting different respondent from the interviews. The responses used in this section are mainly responses to the interview questions regarding the customers.

4.3.1 Adoption Curve

The subfactor Adoption Curve is referring to the fact that different customer groups adopt new technology at various speed. There is a concern regarding being stuck between two customer groups. Further, the characteristics of customers and their drivers for adopting the new technology are highlighted and how this may affect adoption.

A respondent from the Commercial Team highlighted that the customers of the case company are early adopters and said *"Early adopters are the ones that show how it is done, what the outcome is and that is it doable. They are the reference cases that show the majority that it can be done and then they dare to do it as well"*. The

same respondent extended the argument with an example *"You know the popcorn example when you pop a pot of popcorn then there are some that pop very early, and that is where we are now, suddenly the majority starts to pop, and some will never pop. And the ones that never pop they might not live through an industry change with a technology revolution"*. When the same respondent was asked if there was a need to adopt the current offer to reach other adoption categories than the early adopters the answer was that no change was needed to reach the majority of customers. Regarding the same question, another respondent answered *"I think communicating what we do with our current customers would be powerful. The customer only knows a little about the offer and how it works before the first customer meeting"* and thereby suggesting a more active role in attracting new customers.

It was suggested that when adoption reaches a certain level it will accelerate quickly. Highlighted by a respondent from the AV Team *"When the customers start to see that the new technology is coming, then adoption could accelerate a lot. Everyone will realize that the change will happen rather quickly as the technology is starting to get ready for commercial use and scale"*. Further a respondent from the Operations Team stressed that customers are interested in not falling behind rivals and could potentially be pressured by their customers to adopt the technology and said *"The more customers that adopt the technology and the offer, the higher is the pressure [on potential customers to adopt the technology], even from their own customers"*.

Customers may experience pressure from external parties but they need to have internal motivation to adopt the new technology. Several respondents from the Commercial Team raised motivators for and characteristics of current and potential customers. Furthermore, a respondent from the Commercial Team stated that *"It takes courage [from the customers], leaning forward, that you want to drive an industry forward, and that you have a strong value-driven company"*.

4.3.2 Brand Recognition

The subfactor Brand Recognition is referring to the importance of the brand for the company, specifically when attracting customers and the AVs role in branding. A respondent from the Commercial Team highlighted the importance of having a strong company brand, *"If you look at where the company will be in 5-10 years, then things as brand and trademark becomes very important"*.

The AVs play a big role in building the brand. The customers are curious about the AVs as they are new and futuristic, and even though the AV is not yet commercially in use it is heavily used in marketing and branding. A respondent from the Operations Team said *"For us, in the perspective of branding, the hardware is very important, the AV is a very good illustration of who we are and what kind of technology we can apply"*. A respondent from the Platform Team highlighted the role of the AVs, *"To me, the AV is the opposite to a commodity and that is why we offer it and that is why we can enter the market"*. Followed by a respondent from the HR Team who added its AVs role in branding, *"The brand is built on the AVs"*.

Customers seek to be associated with the brand as highlighted by a respondent in the Operations Team, *"The customers want to been seen with us, a lot of focus is on taking pictures and have press releases and actually get PR from the collaboration as well"*. The brand helps taking incremental steps forward in the organization, as explained by a respondent from the AV Team *"What we have done since day one is to show [technological] capability and thereby create excitement, sign more customers, and that leads to more good people joining the team. This gives us the ability to build more capabilities to show to the public, which gets us more customers and employees. One step at a time forward"*.

4.3.3 Customer Education

The subfactor Customer Education is referring to the potentially limited knowledge customers have about novel technologies, in this case, autonomous road mobility. The lack of knowledge seems to be important to handle to make customers comfortable with the offer. Engaging in educational activities such as showing reference cases and doing pilot testing seem to increase customer education.

A respondent from the Commercial Team highlighted that one of the biggest challenges regarding the selling process is the knowledge about the technology among customers. A respondent from the Operations Team although brought up that this is expected as, *"We are leaders in the area we are working so, of course, an educating session is needed with new customers"*. Working with new technology implies educating the customer about the technology and the product offering. A lot of effort is spent on this to make the customer feel confident with the present product, and later on also leading the customer to the full autonomous offer as highlighted by a respondent in the AV Team, *"The most important role we have right now is to make the customer understand that autonomous road mobility is on its way and that they need to reach a higher digitalization level to be able to fully adopt it, and they start to understand, but we have a few steps left"*. Education relates both to helping the customers digitalize their business as well as explaining how the AVs are managed, that transport will work differently and thereby the offer will become cost-competitive. A respondent from the Commercial Team further explained that *"A difficulty is an educational challenge in being as fast and as trustworthy as possible in informing the customer about what it takes to drive AVs, how the process looks, what the consequences will be, what is more expensive, what can become cheaper. It is a learning process that starts at zero with every new customer"*.

Further, other educational challenges are related to explaining the safety of AVs. As stated by a respondent in the Commercial Team *"The customers question the safety of it [the AV]"*, a typical and natural concern among potential customers before they have seen the AV in operation, and that needs to be addressed by the team. Further a respondent from the Operations Team added some common concerns from customers *"Does it stop? Does it stop if someone walks in front of it? It is mainly safety-related questions, a fear of the technology, a fear that it will not act as a*

human had done". One difficulty is that the answers to customers' questions can be unknown or change from month to month due to changes in technology development. A respondent from the Commercial Team highlighted this saying *"It is hard to answer questions. If you ask now and then we do the pilot testing in 6 months, then it will not be the same answer"*.

The education is done both by showing reference cases and doing pilots, although it is mentioned that more needs to be done. A respondent from the Commercial Team highlighted one concern regarding showing customers what has been done *"New and limitedly tested technology needs to prove a lot. There is not enough reference material out and we talk too little about what we have done with existing customers"*.

From the interviews, it seems that as long as customers feel confident with using the product and understand how to buy the transport, they do not need to know more about the technology. Customers of the case company are more interested in getting things shipped from A to B than in the specific vehicle. This was explained by a respondent in the Commercial Team, *"In a future when AV is more conventional, then you will buy transport is pretty much the same way as you do now, the customer will not need to have a lot of knowledge about autonomous technology, but they will benefit as their transport will be cheaper"*.

4.3.4 Existing Market Structure

This subfactor concerns the existing market structure of logistics, which refers to transport being bought from third-party logistics and self-employed hauliers. The way the case company operates in terms of business model, digitalizing the industry and using a platform is not a hundred per cent compliant with the existing market structure. Further, an issue raised was that today, the market for AVs is almost non-existing.

The current structure can make customers more reluctant or unable to change. A respondent from the Commercial Team stressed *"You notice that the ones that are sceptical, they are not ready to make the commitment yet. It is either the cost, the way we are working, or the business model that does not fit"*. Another issue connected to the current structure of the market is that the potential customers might be stuck in agreements, or are not able to close deals that are designed in another fashion, where the company charges for their service in a different way than what is custom. A respondent from the Commercial Team presented another concern from customers regarding the offer, *"One thing that the customers question is the price. That is what most people care about. Also, the way we bill, that can make customer back down as it is not the same way as they are used to today"*. The prices are viewed as infeasible for some customers as logistics is very cost-sensitive. This is mainly because they think they will buy the transport in the same way and translate a regular truck to an autonomous one. This view is inaccurate as fewer autonomous trucks are needed, which was highlighted by a respondent from the AV Team *"People think as they always have done, for example, how many trucks they*

should have. But instead of having a well-planned system, decreasing the number of docks, number of employees, employee spaces, turning space, you can save a lot of costs". A respondent from the Operations Team raised a thought on why cost concerns potential customers, *"The ones that buy transport at companies today do only have cost as a performance index, and now they start to get pressure to become more environmental friendly as well, which is a rather new thing"*.

It is not only the customer characteristics that are important, sometimes even more important are the characteristics of the key stakeholders at the company. A respondent from the Commercial Team highlighted that when the customers are a *"... big global organisation where things are stiff and unresponsive and hard to change, where you have bought transport in the same way in 60 years"*, then an important ingredient is *"...to find the change agents in the big companies that can make the transformation internally, within the company for us"*.

A big obstacle, with the existing market structure, is that the company is unable to cater to all lanes of a customer as of today, which often disqualifies them from logistics procurement. Or other carriers can use the cost advantage of a big network and cut costs. Further, the current value chain does not entirely fit the business model of the company, as stated by a respondent from the Operations Team, *"To get the adoption that we want, a big part of the value chain needs to change"*.

The market for autonomous trucks is almost non-existing at the moment, and the company needs to put in the effort to create demand as a respondent from the Operations Team agreed on together with a respondent from the AV Team who said *"We can help the market create the demand, then we can scale very fast"*.

4.4 Teams

Empirical data showed four particularly relevant aspects to Teams, Talent Management, Locate Experienced People With a Scale-up Mindset, Integration of New Employees and Teams, and Coordination of Work Tasks. The findings are presented by quoting different respondents from the interviews.

4.4.1 Talent Management

This subfactor includes several aspects of talent management. Attracting talent, recruiting quality over quantity, retaining talent, and anchoring new roles to keep employees are features to consider.

Attracting talent refers to how the case company is working to attract the right talent to the company. Firstly, due to the company working with novel and emerging technology and a well-known brand, the company has an overflow of interested candidates for most positions. A respondent from the HR Team said that *"Many think it is a cool company, and what we are doing is new and innovative. So we*

have been able to leverage that and not work as much with employer branding". A respondent from the AV Team agreed on the connection between the technology and employer branding stating that *"What we have done since day one is to show [technological] capability and thereby create excitement, sign more customers, and that leads to more good people joining the team".* The difficulties rather arise in attracting the right talent and later in the selection process, as the company are looking for an international level of candidates. The same respondent from the HR team also said that *"They [the employees] need to be world-class. We are competing with the biggest tech companies worldwide. And finding the competence in Sweden is difficult".* Additionally, the HR Team wants to focus on quality before quantity in the recruitment process, a challenge during scaling as more employees are urgently needed. As explained by a respondent from the HR Team, *"It is easy to not think about each individual, but rather on a volume, and that is lethal, as it is much better for the company to recruit one superstar than three mediocre. [...]. There is a risk that the mediocre ones drag down the stars. We need to find people that carry their own weight".* According to the same respondent, these requirements puts pressure on the recruitment team and may slow down the recruitment process, explaining that *"If we have 300 applications for one position, but none is covering the requirements, then we should not take the best of those 300. Instead, we should figure out how to find someone that fits the requirements. And that is a really hard decision to make when you have as strong growth requirements as we have."* Adding complexity is the fact that the company is still a scale-up, and has a hard time providing enough incentives for some more experienced candidates to join. Another respondent from the HR Team mentioned that *"The salary can not match the bigger companies" and continued with that "The employees can not be afraid of losing their job".*

Talent management is also connected to retaining talent within the company. During the interviews aspects regarding how changes due to the increased scale of the case company may affect the willingness of the employees to continue their employment was brought up. A respondent from the HR Team mentioned that *"There is a lack of leadership throughout the organization due to the fact that many have had to step up early in their career"* and that this affects the organization and the teams. A respondent from the Commercial Team said about the changes that come with the scale that *"What I think needs to be balanced very carefully, a classic clash, is to keep the degrees of freedom and keep the responsibility distributed in a decentralized manner to continue being creative".* Further, a respondent from the HR Team expressed a concern about employees being coveted by other firms, *"Some might see a current window of capitalization of their resume, and in two years time the company might not be as hot at the resume if this doesn't work out, the company might crash. But as of now, we have a really good brand".* Hence, the case company works actively to create sustainable ways to motivate employees to stay. Another respondent from the HR Team described their work as *"We do not like processes, but we need to set how we will work with compensation and benefits, [...], and how we work with the development of our employees"* and that *"We want to be a tech company at the forefront of what we offer our employees and the technology we develop. These should match".*

At a rapidly growing company, employee's roles naturally evolve, and to utilise these new roles fully, there is work to do to anchor the roles in the organization and with the employee. A respondent from the HR Team illustrated their challenge as *"We need to get better at creating the conditions for the employee to succeed in a new role, especially if they have never done it before. [...]. There is a lot we can do to help new leaders to take more responsibility"* and continued with *"It has been challenging for us to be a rapidly growing company where many have had to step into roles that require a lot"*. Another respondent from the HR Team agreed and said that *"There are a few examples of people that were expected to take on a leadership role that they did not want or were not really a good fit for"*. Statements from the interview's highlights that the process of getting a new role differs. Some gradually grew into that role, others were asked to move, and a few were not part of the decision. They were all happy with the change, although it was both challenging and uncomfortable.

Lastly, the respondents emphasized the importance of making long-term decisions that in the current situation seems unreasonable but will, hopefully, create future opportunities for great success. The HR Manager stressed that *"Some of the decisions we take now may seem irrational in the short-term, but we need to keep the long-term in mind, and that is difficult"*. A respondent from the HR Team further explained that *"The challenge is to think scalable and big enough, it is easy to only look at the coming 6 months, what do we need to keep up our hyper tempo? [...]. But the choices we make now is what we will be accountable for in a few years"*.

4.4.2 Locate Experienced People With a Scale-up Mindset

A distinct part of the recruitment process that was frequently highlighted in the interviews was the need to Locate Experienced People With a Scale-up Mindset. Employees with domain experience help to guide technological decisions, but without a scale-up mindset, risk clashing with the company culture. The scale-up mindset is highlighted by the respondents, including the statement from a respondent from the HR Team: *"It is a special environment, and not everyone fits in a fast-paced startup. It is fun, but there are consequences. [...]. The culture is a unique selling point, but also a burden. People often think that they would thrive in a startup, but certainly, not everyone does that"*. A respondent from the Commercial Team added *"If you are sensitive to knowing exactly what to do at all times, then you would generally have a hard time at a startup. And it will be even more difficult at a startup as ours where we try to do a big transformation of something that has been this way for hundred years"* and continued with an example, *"Everything has changed 180 degrees since I started, at least three times"*. On the other hand, there is a need to incorporate specific experience in the company that usually come from large organizations without the scale-up mindset. Another respondent from the HR Team said that *"We need to hire some people that have made similar decisions [around long-term technological choices] a few times over the years that understand how to do it"*.

There is a conflict between the fact that most individuals who have previous expe-

rience within vehicle hardware development have been working at big established truck manufacturing companies and the scale-up mindset needed to be comfortable working in a scale-up environment. A respondent from the HR Team drew attention to this by saying that *"The problem is that you either know the industry and are shaped by it, or you do not know the industry but have the right mindset. The combination of being a street hustler, start-up person but still know the hardware is very difficult to find"*. This might, according to the conducted interviews, create a cultural collision if the wrong individual is employed. Another respondent from the Commercial Team said that *"It is clear that this [a culture of rapid change] affects to some extent, some like change and others do not"*. The respondent from the HR Team concertized this as *"These people have probably worked at Scania, Volvo, Saab, Daimler, these gigantic companies. And to get these people to understand what a scale-up implicates for culture, compensation models, agility, and that they can not work in the same way as Volvo if we want to continue at the same pace"*. The context of Sweden as a country with a few giant truck manufacturing companies, with the characteristics of a multinational corporation when it comes to organizational structure and culture is probably very different to e.g. Silicon Valley companies working with autonomous mobility. This further emphasizes the difficulty in locating the right candidates in Sweden raised by the respondents in the previous subfactor 5.1.4.1. A respondent from the HR Team gave a contrasting comment arguing that *"No company has solved the autonomous technology yet, so that experience is technically non-existent. What is important is how skilled you are at learning new things"*, prioritizing mindset over experience.

4.4.3 Integration of New Employees and Teams

Over the interviews, the Integration of New Employees and Teams was frequently mentioned as something that affected efficiency and thereby scaling. A proper approach integrates new employees efficiently into the team without suppressing their creativity. A respondent from the HR Team highlighted both the issue of bigger teams and new employees by stating that *"When teams grow they become less efficient. Adding to that, learning how to work with new people is difficult"*. How the organisation handles a rapidly increasing number of employees and integrates them into their teams has effects on the whole organization. Inefficiencies in the organisation may occur if this is not handled properly, but the effort is clearly needed to make the new employee a part of the team. A respondent from the Operations Team expressed that *"Integrating others is a demanding phase, there is a lot of extra work and energy required"*. Another employee at the company that was not formally interviewed mentioned that *"In the beginning, 1+1 is less than 2"*. A respondent from the Platform Team agreed and said *"It obviously costs a lot of bandwidth short-term, but the newly hired lift the company in new ways"* and added *"We are growing into our costume because every new employee adds a limb that makes it possible for us to move at the horizons that are needed"*. This positive attitude towards the growing pains of growing teams was shared by a respondent from the Commercial Team who mentioned *"You get a lot of new ideas, even if it gets more difficult in the beginning to integrate the new people"*. Another respondent from the Commercial Team drew

attention to other difficulties of integration apart from the time it takes and raised the issue of *"Having to educate new colleagues on how we do things, what has worked before, etc., without killing their dedication so that they are able to think freely and come up with new smart solutions, is difficult"*. Scaling a company means onboarding a whole lot of new employees during a short period of time, and the context of a changing industry that the company is in makes the integration even more complex. This issue was raised by a respondent from the AV Team that mentioned that quite a few new colleagues started their employment the last couple of months but are only now integrated into the teams because of the scaling process.

4.4.4 Coordination of Work Tasks

Expanding a team means restructuring some responsibilities, by coordinating the work tasks between employees and teams. This happens in all organizations, but what differs an established organization from a scale-up is how often this occurs, and it happens more frequently in a scale-up. At first, this can hamper efficiency as the teams establish themselves, and before the new structure is fortified. The process is facilitated by appropriate communication. According to the interviews, the need for coordination is especially visible as new employees join, but also when the organization is restructured due to other changes. A respondent from the HR Team said that *"The recurring changes force employees to relate to new teams, new routines, new people, and it takes some time before you get efficient and have figured out who should do what"*. As highlighted by some respondents, the changes of colleagues sometimes bring new challenges, as employees are eventually facing new points of views and opinions that need to be considered. A respondent from the AV Team further addressed the issue of frequent change mentioning that it is difficult to know the borders of responsibility between teams. Coordination can help prevent duplicated work, losing sight of important tasks, and knowing who does what in a given situation. Communication is important for coordination, as a respondent from the AV Team said *"The foundation [for coordinating tasks] is to have a really tight communication"*. A respondent from the Operations Team commented on the change in communication and need for structure by saying *"I remember when we were 5 people in the team. Everyone knew everything that happened, and we had a dialogue directly around things that needed to be solved. That is not really the case anymore"*. A complicating factor around coordination of work tasks and restructuring responsibilities was raised by a respondent from the AV Team, *"Some knowledge is tied to specific people, and depending on where they end up [in the organization], that responsibility follows them there [...] even if it is not logically or team-wise correct"*. The non-logical division of responsibility can cause confusion if not communicated very clearly. Communication stretches even further towards having clear descriptions of responsibilities. Most of the respondents had a rather loose work description but had a clear vision of what they were supposed to achieve in their role.

The coordination of work tasks will long-term create structural changes within the organization that creates opportunities for teams and employees to become special-

ized in one specific working area. Growing the company with more human resources allows for more specialized work which creates possibilities to separate the interconnectedness between the teams. A respondent from the Operations Team argued that *"Historically people have been working both with the AV and the platform, but that is probably not the case anymore"*. A respondent from the AV Team argued that it would be beneficial for their team if they could decouple their work from the Operations and Commercial Teams, and not be involved in customer applications. A respondent from the Platform Team highlighted a further issue with specialization *"At the moment, people are used to having their fingers in all jars, but as we grow I think we will be more boxed-in. That change will be really easy for some, and really difficult for others. And that will obviously affect team dynamics"*.

5
Discussion

The discussion of this thesis is structured in two main sections. First, factor specific findings are analyzed and discussed factor by factor to understand how these affect scaling. The analysis is based on the findings in the chapter 4 Results and the previous literature presented in chapter 2 Theoretical Framework. Each factor is divided into fractions based on the subfactors used for coding the interviews. The effects each label has on scaling is divided into how they affect the organization and the technology. Some subfactors affect mainly one of these two, others affect both. Secondly, interrelated factor findings, connecting subfactors from different factors, are discussed. This is done to get a deeper understanding of how the factors affect scaling by influencing each other.

Adapted from the explorative model of business model scalability by Stampfl et al. (2013) (see Figure 2.1), this model sums up the results and demonstrates that all the factors influence business model scalability. It further illustrates the way the subfactors influence each other, see figure 5.1.

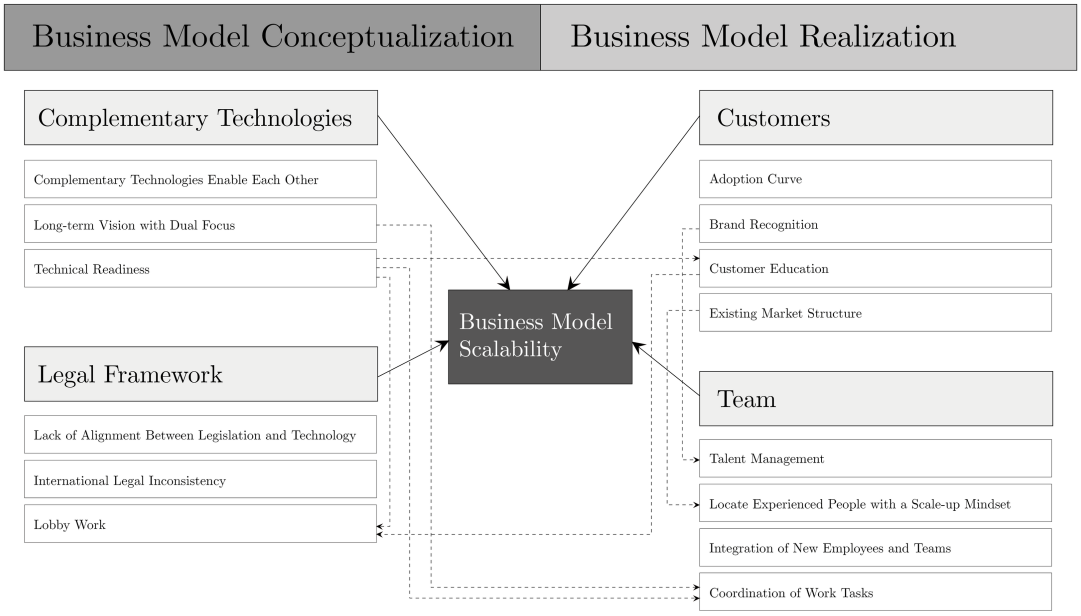

Figure 5.1: An adaption of Stampfl, Prügl, and Osterloh (2013) Explorative Model of Business Model Scalability

5.1 Factor Specific Discussion

In this chapter, the subfactors within each factor are discussed.

5.1.1 Legal Frameworks

Subfactors from Legal Frameworks were shown overall to be a source of uncertainty due to the difficulties to understand and apply legislation, and how it will develop. This mainly affects technology development and diverts time and resources from technology development towards understanding, complying with, and influencing future legislation. The three subfactors covered in the sections are 5.1.1.1 Lack of Alignment Between Legislation and Technology, 5.1.1.2 International Legal Inconsistency, and 5.1.1.3 Lobby Work.

5.1.1.1 Lack of Alignment Between Legislation and Technology

As legislation is not updated to be applicable to autonomous road mobility, it may hamper the scaling process for companies working with autonomous road mobility. The concerns in the interviews regarding legislation not being adapted to the application of autonomous road mobility have been raised previously by Evas et al. (2018) and Lindau (2017) who mentioned that the current legislation is not adapted for the introduction of autonomous road mobility. Through the interviews, it became clear that the lack of alignment hinders the company to develop the vehicles, prioritize features, and increase production due to the uncertainty of what future legislation will look like. Further, this could affect the company's ability to conform to future legislation if they already made technical decisions based on current legislation. As long as legislation is not adapted to technology it will therefore decrease the possibilities to scale. One way to operate under current legislation is by using trial permits. However, these permits limit the number of possible customers, and thereby scalability. Furthermore, the process of applying for, and receiving, trial permits is becoming a bottleneck, as it is not adapted for a larger scale, further enhancing the limiting aspect of trial permits. In addition, the time it takes to understand unclear legislation, which is not even clear to the authorities, hinders scaling as less time is devoted to core business and development. Further, the respondents' concern regarding not being able to communicate what they legally are able to do to customers will hinder commercialization of their product, and thereby probably also the scaling. Through the interviews, it became clear that legislation that is aligned and supports the technology benefits scaling, especially when it comes to the amount of time that is invested in overcoming the obstacles created by legislation.

Two areas of legislation that are not mentioned in greater detail in the interviews, but raised as issues in the literature are cybercrime and data protection (Ilková and Ilka, 2017; Costantini et al., 2020; Olsson, 2018). Cybersecurity is only spoken of in connection to customer's concerns. This can indicate that the respondents see no legal obstacle within this area. An explanation for that could be that, as Ilková and Ilka (2017) mention, these areas need more legal attendance and that the lack

of legislation can be helpful. One respondent mentioned, in relation to EU's GDPR law Article 6 (European Commission, 2016), that data can be processed if it "is necessary in order to protect the vital interests of the data subject or of another natural person". So the fact that the company processes data only to avoid collision, and abstain from storing it, they are compliant to legislation, which thereby ceases to be the obstacle that Costantini et al. (2020) and Olsson (2018) expresses. The favourable characteristics of ambiguous legislation is in addition also mentioned by one respondent explaining that the ambiguity makes room for freedom to test things more easily, which can speed up development. This indicates that the lack of, or very vague legislation can support scalability. Nevertheless, clear, non-adapted legislation currently hinders scalability, but also provides opportunities for companies to be a part of the restructuring of the legislation to become more applicable to the application of autonomous road mobility. Through this, companies have the possibility to influence legislation to become favourable and aligned with reality, increasing scalability long-term.

Synthesis: The lack of alignment between legislation and technology mainly affects scalability negatively by diverting employees' time from core business to overcoming legislative obstacles, affecting the organization negatively. The problems legislation bring to commercialization by limiting the number of potential customers also affects the organization and scalability in a negative way. Further, technology is affected as the uncertainty around technical standards increases risk and complicates prioritization around technological development, which is negative for scalability.

5.1.1.2 International Legal Inconsistency

Through the interviews, it became apparent that the case company is what Oviatt and McDougall (1994) describe as an international new venture, a company that from start seeks to establish itself internationally. To be able to do that, respondents seem to think that this process of scaling the business internationally will be facilitated by common legislation in the future. The present reality, however, is full of legal inconsistencies which exponentially increases both the difficulties of technological development and the time spent on overcoming obstacles that occur on a national level mentioned in the previous section 5.1.1.1 Lack of Alignment Between Legislation and Technology. These inconsistencies thereby moderate scalability to a large extent. Mentioned in prior literature is that the fragmentation of national legislation and technical requirements increases transaction costs for companies working with autonomous mobility. Legal coordination would support the introduction of autonomous road mobility at scale (Evas et al., 2018; UNECE, no date). However, as mentioned in the interviews, bridging international inconsistencies is time-consuming and it can be difficult for one company to influence legislators. The time spent on this could, similarly to adapting to each country's legislation, hinder scaling. It is also difficult to predict the outcome. If the common legislation becomes very restrictive, that could hinder scalability as well. This would have a great effect as all countries within the EU need to comply with EU law due to the primacy of the EU law (EUR-Lex, no date). The same applies for laws made by the UN through treaties most of the European countries have already signed (UNECE,

no date; “United Nations, Vienna Convention on Road Traffic”, 1968).

Findings confirm Stampfl et al. (2013) view that scalability is hindered if the business model needs to be reworked for each country to be compliant with the legislation. However, findings deviate from Stampfl et al. (2013) approach of only planning a business model of a company in a way so that small alterations make it conform to any legislation. Instead, findings further stress the importance of focusing on influencing legislation to suit the business model. In a novel area, such as autonomous mobility, where legislation is frequently changed and updated Stampfl et al. (2013) approach might be complicated, and taking the opportunity to influence legislation instead of the business model could be more rewarding. With that said, the business model should be planned in a way that supports alterations to different legal regimes until unified, and that it is strategically sound to expand to countries with similar legislation.

Synthesis: The international inconsistency and the uncertainty of future legislation increases the negative aspects related to misalignment between legislation and technical development (see section 5.1.1.1) the time of the employees is spent on understanding and adapting to different national legal frameworks instead of developing the technology. This affects both the organization and the technology in a way that moderates scalability of the company. Furthermore, as findings show that actions should go beyond internal adaptability to also influence international legislation, the time spent on that also affects scalability in the short term by diverting time from core business. Common legislation at EU- or UN-level that is not too restrictive would arguably be suitable to support international scaling from the company’s point of view.

5.1.1.3 Lobby Work

Both previous literature and the results from the interviews agree on the importance and benefits of influencing legislators towards one’s advantage, which was quite expected. The case company tries to handle lobbying of opposite interests by engaging in industry organizations to avoid it having a moderating effect on the case company’s own impact on legislators and scalability as Comin and Hobijn (2005) explain is common for all new technologies. Early knowledge of future legislative change will have a positive impact on strategy, and thereby on scalability (Ozer and Markóczy, 2010). However, this is not something that is raised as an advantage in the interviews. The respondents instead highlight that lobby work takes time and needs to be started in time to give results. They are not explicitly stating it to be a long-term investment that is difficult to prioritize, rather focusing on their responsibility to change the current structure, a surprisingly proactive approach. This approach is aligned with Sutton and Rao (2014) whose research states that focus needs to be set on the future, even if actions give no immediate impact. One fact that could possibly make lobby work more complex is that national legislators are in some areas bound to follow regulations from the EU and the UN (EUR-Lex, no date; UNECE, no date). Therefore the national lobby work could have a hard time gaining concrete support in legislation and thereby diminish the positive effects on

scaling. Hence, the positive effects could potentially increase instead if lobbying efforts were directed directly towards the EU or UN. That would possibly at the same time solve some of the issues discussed above around international inconsistency in section 5.1.1.2 International Legal Inconsistency.

Synthesis: Lobby work mainly affects scaling positively, although short-term it may affect the organization negatively as it requires company resources, such as employee time, focus, and financial resources. This investment has the potential to give future rewards as legislation becomes advantageous and moderate the negative impact on scalability by the non-applicable, fragmented legislation from the previous two subfactors 5.1.1.1 Lack of Alignment Between Legislation and Technology and 5.1.1.2 International Legal Inconsistency, even if the time it takes at the present hinders scaling short-term. By extension, this also affects scalability positively as this decreases uncertainty regarding future legislative developments. This affects technology positively as it can guide technical decisions and prioritizations.

5.1.2 Complementary Technologies

Subfactors within Complementary Technologies were overall focused on technology, how the two technologies are interrelated, how important it is to have a solid long-term vision especially when there is a duality in the offer, and how a rapidly developing technology can create trouble when scaling a business. The three subfactors 5.1.2.1 Complementary Technologies Enable Each Other, 5.1.2.2 Long-term Vision with Dual Focus, and 5.1.2.3 Technical Readiness will be discussed. These subfactors mainly affected technology development. Furthermore, these were the most frequent subfactors to affect subfactors from other factors, discussed under 5.2.

5.1.2.1 Complementary Technologies Enable Each Other

Findings showed that the complementary technologies need each other to attract customers in line with Adner (2006) and Teece (2010). Applying the theories of Teece (1986), the platform and the AV would be cospecialized complementary technologies, as they are bilateral independent of one another and enable each other existence.

From a commercial perspective, the platform helps to identify the customer's transportation flow where the AV, later, can be used. This eases the process of finding suitable customers and facilitates the scaling process. Further, which will be discussed in detail in section 5.1.3.2 Brand Recognition, the AV is an important component for awakening customer interest in the company. This is an essential part of the correlation between the two as while the platform is in use generating revenue, the AV can be further developed. The complementary relationship makes the total customer offer and business model more interesting for investors as the platform can create revenue already today, in line with Stampfl et al. (2013) who claims that a scalable business attracts investors. Having a long-lasting recurring revenue can be

used for further technical development.

In the context of technical capabilities, the platform enables the AV as it cannot be used without being controlled and managed through the platform. The technologies do not only enable but also enhance each other's capabilities and performances. The AV increases the value of the platform as the more AVs registered in the platform the greater the value of the platform. Further, the AVs require a level of functionality from the platform to operate properly, the capability and performance of the platform are accordingly forced to reach a higher level of development. The interviews showed that the company sees great value in customer data, which facilitates scalability (Huang et al., 2017). This data can be used for optimization and customer-based development of the autonomous road mobility technology which will increase the quality of the final product, enhancing the technology development.

The findings also showed that while the AV technology is developed, the customers have been integrated with the platform and the necessary development of their IT systems has started. This increases the incentives for the company to implement the platform with customers now while continuing the development of the AVs and wait for the right timing to commercialize them. This is supported by Adner (2006) who states that the commercialization of a product can benefit from being delayed so players in the market to become more ready for it. Further, Stampfl et al. (2013) state the importance of growing along with market dynamics. Concluding, the technologies complement each other both commercially- and technology-wise which facilitates the scaling process.

In contrast to what Adner (2006) presents about innovation ecosystems the complements are in this case not developed by another party in the innovation ecosystem but the development of the complements are internalized into one company. A potential reason for internalizing this is to decrease the dependencies that come with being a part of an ecosystem, explained by Adner (2006) as a potential risk. This way of internalizing the development is supported by Nalebuff and Brandenburger (1997) who state that when a complement is missing, the company should get involved. Although this way of internally taking responsibility for two complementary technologies may decrease the risks associated with being a part of an innovation ecosystem, it increases the development risk. The effect this has on scaling will arguably depend on the success of the development and commercialization of the technologies. Failing may cause the whole offer to lose its value. Although, successful development of the two may enhance scaling a lot more than if the company only offered one of the technologies, similar to the increased customer value generated by an innovation ecosystem.

Synthesis: The two technologies, the platform and the AV enable each other's existence, both commercially and technically, and are more valuable together than the sum of them separately. The platform enables and enhances the AV as it allows for collecting customer information and operational support, both of which allow for better product development and accelerates the customer's readiness. The AV en-

ables the platform by demanding high-level technological capabilities of the platform to be able to manage the AV. The more AVs registered in the platform the greater is the value of the platform. The co-specialized relationship between the technologies enhances the scaling process through technology development. Although, by internally handling both technologies the development risk, the risk of unsuccessful commercialization of the technologies, increases, which may hinder scaling.

5.1.2.2 Long-term Vision With Dual Focus

A long-term vision can guide the decisions of today, even if it is not always the logical choice seen to the current circumstances. There are greater environmental and cost-cutting effects that are waiting to be unlocked, and until the autonomous technology is ready for that, it is important to keep the company afloat. The case company does not look to make fast money but rather focus on the long-term profits that can be earned from the AVs and the platform together. This is in line with Grant (2016) who states that establishing goals that are consistent and long-term is important to reaching success, highlighting the importance of keeping the long-term vision also in short-term decisions. Decisions that seem non-logical short-term are easier to take and prioritize if these are guided by the long-term goal. Keeping the long-term focus will arguably facilitate the scaling process.

The importance of balancing under- and overinvestment is high. Overshooting demand and mismatch the market can be detrimental, meaning that you can scale too fast. The opposite, underinvesting in one technology, can lead to loss of market advantage and current customers. It is important to understand how and where the company should compete and what different critical factors are for reaching goals in the future, highlighted by Flamholtz and Randle (2007). The long-term vision affects decisions regarding technology. The decisions made today about what technology to use will impact the future success and decrease technological flexibility. If something is poorly chosen, reversing it, later on, will probably take time and resources and impact the scaling process. From the interviews, it was shown that the company is trying to make technical decisions today that will have a positive impact on the company in the future. Both looking at the production of AVs and the development of the software for the AV and the platform. If wrong decisions are made today, these might not become obvious until later.

From the interviews, it was found that long-term scaling requires some decisions to be made and actions to be started early, even if they are not relevant or pressing at the moment, just to be ready when the time comes. This is in line with Sutton and Rao (2014) who argues that it is beneficial for growing companies to make decisions based on what is best for the future version of the company. This may enhance long-term scalability but might hinder short-term as resources are put into "non-essential" work. This long-term work can not take over current important work that keeps the company afloat because that may also hamper scaling.

The duality created by the two complementary technologies may hamper the scaling. As previously discussed (see section 5.1.2.1) there are positive consequences of

developing both technologies. As the products are complementary, both arguably need to be prioritized to reach the full potential of the total value proposition. This can be a problem as trade-offs might appear and resources are scarce. Allocating too few resources to either may affect the performance of the technology innovation and prioritizing one of the two complementary technologies can result in the other lagging behind and lose its "power of enhancement". Effective resource allocation and dynamic decision making are important for parallel product development (Brilhuis-Meijer et al., 2016. The case company is working towards having resources that are dynamic and can be moved around in the company if needed, working in line with what literature suggests (Lee et al., 2015). The same type of resources are needed and can be used in both technologies. During the past year, the case company experienced a shift of resources towards the platform as it was prioritized higher than the AV. The long-term vision is therefore extra important to guide decisions when trade-offs and prioritization in resource allocation appears.

The findings showed that the case company wants to base their technology development on the needs of their customers, in contrast to what Bower and Christensen (1995) states about listening to existing customers when developing a new product. Although in line with Slater and Mohr (2006) it can be argued that if the case company is listening to their current customers, the early adopters (see section 5.1.3.1) they can still disrupt the market with their new technology and be successful in their scaling. Furthermore, Stampfl et al. (2013) underline the importance of solving existing customer problems to increase scalability. Customer preferences can help prioritization among several important features to create the most value for customers, and thereby increase scalability. The already existing use of the platform enables the company to collect information about how the customers interact with the platform. This guides adaptions to increase usefulness and value for customers. There is no doubt that the customers play a big role for any company. Although, careful consideration of which customers to listen to is important, as is how customer data can be collected and used to make the right technological decisions for all companies working with new technologies.

Synthesis: The Long-term Vision with Dual Focus arguably affects scaling in several ways. Firstly, affecting the organization, long-term decisions may be non-logical short-term which make them hard to understand for certain stakeholders and therefore difficult to make. It is important to not over-or underinvest as the first may create a mismatch with the market, overshooting demand, and the latter may lead to loss of customers or competitive advantage. Secondly, the technology is affected, as the long-term vision needs to be anchored in the technical decisions as well. The wrong technological decisions today are hard to reverse in the future and can become great challenges for the company. Furthermore, there is a difficulty in the duality due to the existence of trade-offs and the risk of one technology lagging behind the other, losing its power of enhancement. The customers' role in technology development decisions needs to be of careful consideration to not follow the wrong customer needs. The effect of making the right long-term decision may not immediately affect scaling, positive consequences may only appear in a few years. However, short-term

the right decisions may affect scaling negatively.

5.1.2.3 Technical Readiness

Technical readiness seeks to explain the impact on scalability from technologies under continuous development that not yet are ready for commercialization, issues regarding this were found in the interviews. A company working with autonomous road mobility seems to be highly digitally mature, and will according to Huang et al. (2017), experience rapid scaling. Stampfl et al. (2013) and Nielsen and Lund (2015) state that technology enables company scalability, arguably implying that even though the technology is not ready for commercialization yet it will enable the company to scale. In addition, as stated in the interviews, the technologies will continue to develop along the way.

Autonomous road mobility is a novel area and there are still many unsolved technical issues making it hard to scale. Looking more specifically at what makes the hardware difficult to scale can be understood through the interviews. It requires both more space for tests and customer pilots, and human resources to manufacture, develop and test, and has extra exposure to legal difficulties. The many physical resources and big capital requirements hinder scalability (Nielsen and Lund, 2015). Although, as the technical readiness of the hardware evolves towards commercialization, the number of people that needs to be involved decreases which then arguably will enhance the scaling. Software, on the other hand, is in general designed in a way that makes it easier to scale (Hallowell, 2001). It does not require an extensive amount of people handling it and no physical space. Although, the interviews revealed some issues with scaling the software as well. One thing that slows down the scaling of the platform is the need to pair it with the customers' software. Further, when scaling internationally other features, like different languages and time zones, needs to be added. In the end, the key is to understand when the technologies are ready enough to fulfil customer needs. The technology will be under continuous improvement, and delaying commercialization will postpone revenue and thereby scaling.

The complementary technologies, being one hardware and one software, qualifies in on opposite sides of the scalability continuum established by Hallowell (2001). From interviews, it has been made clear that the platform is easier to scale than the AVs, which is in line with what Hallowell (2001) presented. This research has not managed to bring clarity to how or if the fact that the platform and the AVs lie at the opposite ends of the scalability continuum affects the scaling process.

Synthesis: The challenge to scale the AVs with its technical readiness as it is today, is connected to the need for human resources for testing, handling, and manufacturing. The platform also faces some challenges to scale due to the level of technical readiness. For example, pairing the customers' software with the platform and when expanding internationally requires adding some features. An interesting aspect of a business model that intertwines hardware and software products is that these are particularly different to scale. The increased technical readiness will arguably affect scaling positively as increased readiness of the technology supports the scaling

process.

5.1.3 Customers

Subfactors of Customers were shown to both affect scaling through the organisation and the technology. Customers have an important role in a company. They are both often the source of revenue and can help guide the technical decision. Their role when scaling the company is, in line with this, highly influential especially for a company working with technology innovation. The novelty of the innovation brings aspects such as adoption rate of it, a need for educating customers about it and hardship to fit into the current market structure, all if not handled properly may hamper scaling. Although the novelty brings an opportunity to build the brand around the new, futuristic technology, that can be used to bring in more customers and enhance scaling. The factor Customers comprises of four subfactors described in the sections 5.1.3.1 Adoption Curve, 5.1.3.2 Brand Recognition, 5.1.3.3 Customer Education, and 5.1.3.4 Existing Market Structure.

5.1.3.1 Adoption Curve

Several aspects might affect the adoption of the new technology of autonomous road mobility. The successful adoption of the technology will affect scalability of the company positively, as this requires increasing the customer base to strengthen profitability.

The current customers described in the interviews are interested in new technology and are ready to sacrifice some functionality to be first in line for the new technology. Their characteristics show that they are early adopters, which is in line with what Liljamo et al. (2018) says about what customer group that at the moment view autonomous road mobility positively. Adopting a technology when it is still novel requires a certain type of customer characteristics and motivation. It can be complex to find customers who are willing to take the risk early on and are suitable for the offering. Once they are found, the next category of customers needs to be convinced. In connection to this, Moore and McKenna (1999) also raises the concern about being stuck in the chasm between early adopters and early majority, and as Liljamo et al. (2018) states, that autonomous road mobility is following the general pattern of technology adoption, there is a risk of this happening. The company risks not be able to cater to any of the customer groups need if trying to focus on both the early adopter and the early majority at the same time. Among the respondents, there was some disparity in opinions about how to tackle this potential problem, some preferring a more active approach, others a rather passive. Neither of these seems to be wrong. The approach explained as passive is not fully passive but rather puts its focus on the early adopters and then trusting the process of them spreading the word. This is in line with Moore and McKenna (1999) who states that the customers of the early majority adoption category want to see reference cases with positive reviews from trusted parties before adoption. In contrast, the advocates of the active approach suggested a change in the way they show and market their offer to the customer. This is likewise in line with Moore and McKenna (1999) stating

that there is a need to change the initial marketing approach to reach the early majority as their preferences are different compared to early adopters. In conclusion, the active and passive approaches are not conflicting but may enhance each other. The active approach requires some additional resources but may together with trusting the process and working with early adopters be the most suitable approach. Either way, the pressing matter is to overcome the chasm between early adopters and the majority of customers. If not, the scaling process is hindered and it may cause severe damages to the company as it also means lack of income due to the potential inability to cater to any of the two adoption categories.

The adoption of autonomous road mobility is, according to the interviews, approaching rapid acceptance among customers. It is mentioned in the interviews that current customers are equally driven by sustainability and cutting costs in their logistics, which sometimes are not compliant at the present, as autonomous road mobility is not yet fully optimized or commercialized. As it gets more developed the efficiency of road mobility will, according to Mersky and Samaras (2016), increase and thereby lead to reduced costs and lower environmental impact. With both these aspects fulfilled, the price-sensitive customers will be more prone to adopting the technology and offer as a whole. The technology development and optimization of it will hence lead to increased adoption and have a positive impact on the scaling. This is in line with Bower and Christensen (1995) theory regarding disruptive technologies, they initially do not satisfy all needs of the majority of customers but when developed further these customers will see the value in the new technology.

Findings also showed the need to identify which customer segments to focus on, which is in line with Cantamessa et al. (2018), stressing the importance of this for successful commercialization. Focusing on the customers that are ready to adopt the offer, will require fewer resources than if focusing on the ones that are not ready yet. In the interviews, it is mentioned that the adoption category called laggards might not survive the industry change, which would suggest that resources may be wasted if spent on these customers now. If the company puts a lot of effort into bringing them in it might be for no good and a lot of resources has been wasted.

Synthesis: The adoption curve has a strong correlation to scalability of a company as an increased amount of customer often equals increased scale. If handled correctly, the adoption curve can generate a positive outcome with acceleration in adoption. The adoption curve mainly affects the organization as processes in the organization are the critical factor of success. The company needs to find its customers, which today seem to be the early adopters and then succeed to not get stuck in the chasm between them and the early majority. The customer characteristics and drive is an important factor in their willingness to adopt new technology. In the context of autonomous road mobility, the main goal is to reach efficiency in both sustainability and cost in the offer as this will attract more customers. Increased adoption and number of customers means more resources for technology development and use cases to base technology development on. Therefore, the mechanism of the adoption curve affects scalability positively.

5.1.3.2 Brand Recognition

Based on the interviews it can be seen that branding is essential for attracting customers and increasing knowledge about the offer. This is in line with Konecnik R and Ruzzier (2015), who highlighted the importance for a newly started company to build a brand and through this become successful in the market. The AV is viewed as a new, interesting, and futuristic technology, which gives the company a lot of appeals. Lack of branding activities may arguably decrease customer knowledge and the ability of the company to attract customers. The interviews showed that the case company takes one step at a time, developing the AV, increasing excitement among customers and potential employees by showing what has been done, which allows for further development of the AV. This is in line with Konecnik R and Ruzzier (2015) who highlight the iterative and symbiotic development of the brand and attracting new customers. This loop-based in branding affects the scaling process positively.

In the interviews, the customers' willingness to identify with and benefit of the case company's brand is brought forward as an important part of the customer offer. The brand of the case company then increases in importance as it not only should attract the customers but also be strong enough to be a part of the customers' branding.

In the long run, the AV is believed, by the respondents, to become a commodity and not be as valuable for branding. A strong brand is hard for competitors to replicate, and will thereby contribute to a company's competitive advantage. It is further important that the brand should be durable otherwise the value will erode. (Grant, 2016). It can therefore be argued that if the brand is built on something more than the AV the strong brand will still be a competitive advantage, even if the AV becomes a commodity.

Synthesis: In conclusion, brand recognition affects scaling and the organization positively. This, as a strong brand brings increased customer knowledge, increased possibilities to attract both customers and potential employees, and works as a long-term competitive advantage. Although, it is important to bear in mind that AVs are potentially becoming a commodity in the future which may generate challenges in the context of branding, due to the inability to use it as new, futuristic technology. Furthermore, the technology is affected by brand recognition as more customers and employees increase the resources for technology development.

5.1.3.3 Customer Education

Presenting a new technology innovation to the market means that there will initially be a lack of knowledge about the technology as the concept is novel. Customers need education about the new technology to be willing to adopt it. A company can increase education efforts by for example showing reference cases. Through this the general customer knowledge will arguably increase, leading to more customers adopting the technology. According to Stampfl et al. (2013) increasing the familiarity of the technology among customers will enhance the scaling process, and that the lack of knowledge can be inhibiting. However, investments in customer education can

moderate scalability in the short-term (Stampfl et al., 2013). Educating customers also has a long-term purpose. Not all customers will, as previously discussed (see refsubsubsec: Adoption curve), adopt the new technology at once. Starting to educate customers about the autonomous technology today leads to increased general knowledge level about it in society. This will arguably both affect future customers to be more confident with autonomous road mobility and accelerate the adoption of the offer.

Although a higher level of education in the area of autonomous technology may have positive effects on the scaling process it can also be argued that there are risks of too much information being shared. There are potential risks in the business model of the company becoming obvious, and that intellectual property is leaked to competitors and used for imitation. This reduces the competitive advantage of a disruptive scale-up like the case company and can lead to hardship for these companies to compete with incumbents. Another risk of excessive customer education is the dilution of the brand. As mentioned, the case company can use the autonomous technology as a way of branding themselves based on the newness and the hype around the technology. Increased general knowledge about it would potentially cause this advantage within branding to disappear. An obvious and imitable business model and dilution of the brand may hamper scaling.

Education spans different subjects, where safety and digitalization are the most critical areas brought up in the interviews, in line with what Liljamo et al. (2018) says about customer acceptance of autonomous road mobility. There is a correlation between customer knowledge and technology readiness. When the technology develops more, the capabilities of the vehicle and its safety increases, making it easier to explain and show how the vehicle works. Although, in the interviews, it is argued that customers' knowledge about the exact functions of the technology is not needed. The customer does not need the in-depth knowledge about the technology, they are more interested in knowing about how to buy the transport. However, one factor that is important for the customer to understand is the need for a higher level of digitalization. To be able to fully implement autonomous road mobility in their transportation network this seems to be essential. As brought up in interviews, this change can be rather big for the customer and can therefore affect scaling negatively due to the inability or unwillingness to do a big investment to become more digitalized.

A systematized way to educate customers is beneficial for increased customer education. By using the platform and pilots now, the company can prepare the customer to be equipped when the AV is technically ready to be fully commercialized and used. Although, as the case company is now looking to go internationally, there are aspects that may affect customer education internationally. For example, Hornell et al. (1972) states that the psychological distance like language and culture can hamper information flow from and to the new international market. Further, Cantamessa et al. (2018) also stresses the importance of taking into account that different customer segments have different attributes such as willingness-to-pay when

entering a new geographical area.

Synthesis: Increased customer education mainly enhances scaling, the more customer knows about the technology and the offer, the more likely they adopt it. Customer education affects the organization as uneducated customers require company resources to increase the education level. Challenges of explaining the technology may occur as it is continuously developed, although it can be argued that the customer does not need to be fully aware of how the technology works. Instead, they need to know that the technology requires a high level of customer digitalization and that it is reliable and safe. When internationalizing additional educational challenges may occur due to increased psychological distance. The reason why increased customer education does not only enhance scaling is due to the potential risk of sharing too much and leaking sensitive information.

5.1.3.4 Existing Market Structure

The existing market structure within logistics has been the same for many years. There are established processes for how transport is handled and bought. Companies working with autonomous road mobility are facing a challenge in changing the existing structure to suit the implementation of autonomous road mobility. A start is to influence individual customers to become more comfortable with a new way of buying transport. Looking at the case company, their business model does not entirely fit the existing regular way of selling and buying transport. If these cannot be matched it poses a big threat to the scaling process. Another obstacle is that they are unable to cater to all lanes of a customer as of today which might become a disqualifier and limits the number of potential customers.

In the interviews, it was explained that the existing value-chain of buying transport does not entirely fit the business model of the case company. A majority of the transport buyers are not used to buying transport directly from the vehicle developers and to be as involved in the handling of transport overall. Furthermore, the self-employed hauliers that buy trucks today are not incentivized to buy AVs as their profession is to drive the trucks. This causes the need for the value chain to change to fit a business model containing autonomous road mobility within the transport sector. If no change is made there might be too few customers to scale or even survive. The process of changing the value chain will arguably be time-consuming and met with resistance from some parties. However, the change of the value chain does not need to be made at the industry level, it can be made incrementally with one customer at a time. This implies that the existing market structure will not be an impossible obstacle to overcome and that there will be enough customers to scale. Furthermore, the change in market structure is difficult for incumbents to initialize, as they have difficulties changing their existing business model.

Adding to the discussion about changing the value-chain to find a big enough customer segment, the company needs to have an active role in modifying the existing market and in extension creating their own market. Influencing the structure of the market or the behaviours of market players to improve the competitive position of

the company can be done by eliminating some players from the existing structure or building a new market structure (Jaworski et al., 2000). This is applicable to the situation of the case company as the market for autonomous road mobility within transportation is almost non-existing at the moment, and the company needs to put in the effort to create demand.

The structural change that is needed is favourably supported by change agents at customer companies. It was argued in the interviews that these individuals had the power and courage to make the transformation internally. This is supported by Wickenberg (2013), stating that change agents can efficiently implement change in an organization. These individuals may help to overcome challenges with the existing market structure from within the customer company, and thereby enhance the scaling process.

Synthesis: The existing market structure hampers scaling as it does not entirely fit business models including autonomous road mobility. For example, the hauliers of today are not incentivized enough to buy AVs. The organisation is affected as the existing structure requires employees to handle resistance towards the offer. There are ways to mitigate the damages to scalability, through change agents and incrementally change of the structure. This may instead have a positive impact on scalability.

5.1.4 Teams

Subfactors from Teams were shown overall to be a balancing act between decisions that enhance scalability in the short-term or long-term. They also highlight the difficulties of company growth. This affects both the quality of technology development and the organization as change and temporary inefficiency is introduced because of the growth of the teams. The four subfactors to Teams are covered in the sections 5.1.4.1 Talent Management, 5.1.4.2 Locate Experience People with a Scale-up Mindset, 5.1.4.3 Integration of New Employees and Teams, and 5.1.4.4 Coordination of Work Tasks.

5.1.4.1 Talent Management

Literature expresses the overarching challenge for startups to attract talent, which can be interpreted to apply to scale-ups as well. Kotter and Sathe (1978) mention that the lack of resources to reach out to and attract candidates is one of the biggest hurdles. However, through the interviews, it was obvious that this did not apply to the case company, as the brand and technology work as employer branding as well. Further, Bhide (2000) raises the challenge of not attracting experienced candidates because of not being able to offer the same salary or job security. This was mentioned as somewhat of a problem during the interviews. Attracting talent seems to be one of the keys to facilitate scaling as the company cannot grow without more human resources.

However, attracting talent is just the first step, and hiring the right people is the next. The results from the interviews cover several topics, but the challenges and consequences around recruitment are almost unanimous and can be summarized in the complex balancing act between hiring only the top candidates to ensure top quality, and the urgent need to expand the workforce to keep momentum. Both have negative consequences on scaling if exaggerated. Looking for the best of the best can be time-consuming and thereby limiting as that might hinder hiring someone at all. Sometimes a pair of hands are needed now to be able to carry the workload and keep the pace up of developing the technology to scale the company. On the other hand, everyone needs to carry their own weight and hiring someone that is not top-level, just to fill an employee growth-quota, can reduce the capability of the whole team which can be destructive for scalability. These findings partly agree with research that underlines the importance of teams that works well together and helps each other work at top-level is more important than hiring individual top talent, and that the team is the foundation of scalability (Sutton and Rao, 2014; Stampfl et al., 2013). The HR team emphasized the same ideas that have been suggested by Kotter and Sathe (1978), to only hire the right people at the right moment.

The next topic discussed around talent management is how to retain talent in a company in the process of scaling. One aspect mentioned in the interviews connected to a scaling company was the development of roles and, as a consequence, the somewhat lack of leadership. This phenomenon is explained throughout the reviewed literature. Challenges regarding leadership grow along with the size of the company, and difficulties arguably arise when promoting technical specialists into leadership roles, both for the individual and the team (Harnish, 2014; Flamholtz and Randle, 2007). This development is what has happened at the case company, and difficulties were addressed in the interviews. Kotter and Sathe (1978) point out that it may be hard for employees to adapt to such a change of responsibility and work tasks, especially if it was not desired. Flamholtz and Randle (2007) further emphasizes that efficient leadership is needed to scale and that hierarchies help to delegate responsibilities which is important to facilitate scaling, which is also mentioned in the interviews. The challenge regarding leadership was remarked several times by the respondents, and to not let the lack of experience around management risk scalability, the company anticipates providing more support to new leaders.

Synthesis: Talent Management consists of balancing several decisions that might hinder scaling in the short-term but increase the company's future ability to scale. For instance, the balance between being patient and only employing the best people, but at the same time avoid compromising on the ability to increase technology development due to being short-staffed. The effect non-proper handling of these decisions has on the organization is that it creates tensions for employees who might need to carry a larger workload to keep momentum in technical development if recruiting is restricted. If resources are lacking, technology is negatively affected. Promoting employees, inexperienced in management, to leadership roles without proper support proved to affect the retention of employees negatively. Both the lack of resources and leadership will cause stress on the company that will impact scaling

negatively.

5.1.4.2 Locate Experienced People With a Scale-up Mindset

The interviews highlighted the dual focus needed when recruiting new employees, and that a trade-off might have to be done between truck manufacturing experience and a scale-up mindset. This increases the difficulties of locating the right candidates highlighted in the previous subfactor 5.1.4.1 Talent Management, which most certainly has negative consequences for scaling if not solved. Choosing a candidate with previous experience in truck manufacturing will help increase the robustness in the teams, and could potentially be a solution to the lack of leadership mentioned earlier. This would benefit scaling as experience could help make better choices around the technology. At the same time, hiring someone without a scale-up mindset, or that is too path-dependent to prior experiences that prevent defying previous knowledge, would arguably have the opposite effect on scaling. This could either lead to counteractive behaviour which would slow down technology development, or high employee rotation as employees tend to leave if they are not comfortable in their role. Mathews (2012) mentions that employees need to adopt the culture to succeed. The lack of a scale-up mindset could further divert too much of their time and focus towards trying to create order and counteract the scale-up culture that fosters creativity and agility, that Churchill and Lewis (1983) express is important to keep growing. And the opposite could happen if someone with a scale-up mindset but the lacking experience is hired. To moderate the negative impact that has on scaling, both literature, (Kotter and Sathe, 1978), and respondents mention that on-the-job training is important. A moderating factor that potentially could lead to not having to choose between the two characteristics is the difficulty startups have of attracting experience that Bhide (2000) mentions. This might already shift out the experienced people without the right mindset, as they are not attracted to what a scale-up can offer.

As mentioned by Churchill and Lewis (1983), the scale-up mindset increases the flexibility and adaptability of a firm, which helps move forward quicker. However, interesting to note, as firms grow, the need to organize the company in a more structured way also grows to keep efficiency up (Greiner, 2018). The need for new organizational structures is further accelerated if the industry the firm operates in is under change (Greiner, 2018), which can be said about autonomous road mobility. This change can be difficult for employees to adapt to, as they might value the ad-hoc structure more and feel like their freedom is getting limited. Sutton and Rao (2014) claim that employees and managers struggle with understanding the increased complexity and thereby are reluctant towards the more formal structure. The structure is not the opposite of entrepreneurship and flexibility, and having no structure can do more harm for scalability than the lowered degrees of freedom (Davila et al., 2010; Flamholtz and Randle, 2007). The respondents from the HR Team seem to agree with the literature, while it is clearly visible among some of the other respondents that the structure that scaling has brought is difficult to adapt to. Filling a company with employees with a strong scale-up mindset will hopefully result in a team that is comfortable with change, rapid growth, and in the end also

structure. The risk is that the same people might counteract the efforts of creating structures that would support scalability.

Synthesis: Hiring experienced employees would mainly affect scalability positively, as inexperienced employees are more prone to make poor choices that will make the technology development suffer. This affects technology to a large extent. To keep momentum, agility, and creativity in the organization, a strong scale-up mindset is needed, and the lack thereof could affect productivity which decreases scalability. However, reluctance towards structure can also be negative for scalability, as it introduces chaos into the work environment when the company grows and complexity increases, which affects the organization.

5.1.4.3 Integration of New Employees and Teams

The importance of finding a way to integrate new employees into the company is sizeable and the magnitude of it increases as the company grows rapidly. This is needed both to not use too much of the current resources, other employees' time and to make sure that people feel good working at the company from the beginning to not risk losing them at an early stage. The quality of the onboarding process of new employees suffers if many are hired simultaneously (Kotter and Sathe, 1978), which was indicated by one respondent mentioning that it can take up to several months to integrate new employees properly. This suggests that this issue is common for companies that are rapidly scaling. Difficulties of integration could arguably increase when hiring international employees. This was not mentioned in the interviews, but Hornell et al. (1972) mentions that the flow of information is restricted by language and cultural differences. Regardless, it is inevitable that the productivity of current employees dips during the integration, but what can be influenced is for how long. Poor integration would affect scalability negatively as it takes more time for the employees to get comfortable and carry their own work, implying that unnecessary resources are spent on integration instead of the core business. Scaling, as mentioned, seeks to increase revenue at a faster pace than resources are added (Carucci, 2016). Another example of poor integration would be to repress the creativity of new employees, as these bring fresh ideas and can help unlock challenges. Without that, one plus one has a hard time becoming more than two, and thereby limit scalability.

Synthesis: The integration of new employees and teams has a direct impact on the scaling of the company mainly by affecting the time that can be spent on technology or business development. Initially, experienced employees redirect some of the time they spend on core business towards the integration of new employees, leading to lowered productivity. However, if not engaging properly in the integration from start, scalability will be hampered for a longer amount of time as new employees are less likely to quickly become independent. Additionally, utilizing the ideas and imagination of new hires can significantly help to solve technological problems and support scalability by increasing the company's output exponentially in relation to the number of new employees. The integration of new employees and teams thereby both affect the technology and the organization.

5.1.4.4 Coordination of Work Tasks

The appropriate coordination of work tasks will arguably make the organisation better suited for sustainable growth and thereby scaling. Highlighted both in literature, (Flamholtz and Randle, 2007), and in the interviews was that if work tasks are not coordinated there is a risk of inefficiencies as several employees might do the same job or tasks not getting done at all as no one is really responsible for doing them. Issues seem to increase when the company grows with more employees or at larger organizational restructurings, which makes it even more important to be aware of when scaling. The fact that the number of relationships to keep track of increase's exponential with the number of employees, indicates that the complexity of communication grows (Kotter and Sathe, 1978), was also mentioned in the interviews. This means that the negative consequences of scaling will grow as the company grows if work tasks are not properly coordinated.

Helping employees understand their tasks and what they are hired to do will in turn help to coordinate work tasks more easily. As mentioned in the interviews, most of the respondents' work descriptions were more or less vague, but none of them felt unsure of what they were supposed to achieve. These findings diverge from prior research that suggests that poor work descriptions make employees unsure of their role and objectives (Flamholtz and Randle, 2007). This indicates that the work described in itself is not the most important part of the coordination of work, but the overall structure and management of teams.

The benefits of specialization of work were both mentioned by the respondents, as well as previous literature (Smith, 1791; Slack et al., 2010). Letting teams focus on one specific issue helps them get better at that and frees up time to really get into what they are hired to do and thereby using the resources wisely. This will lead to faster development of the technology, which will support scalability. The biggest disadvantage suggested in the literature was that teams risk silo-work and that a lost connection to other teams will increase inefficiencies and potential rework or need for alignment will increase and thereby slow down technology development instead.

Synthesis: Proper coordination of work tasks will utilize resources and minimize the time spent on unnecessary work, which will be beneficial for scalability, and primarily affects the organization positively. Unambiguous and efficient management, as well as clear tasks and objectives, are important aspects to be able to coordinate sufficiently. Further, good communication strategies will also influence coordination and thereby increase scalability.

5.2 Interrelation Between Factors

Below a discussion is held around how some of the above findings from one factor relate to other findings connected to a different factor. These interrelated findings are not comprehensive, but a selection of the findings that were perceived to add

to the discussion. The relations between subfactors from different factors follow the structure of one subfactor influencing another subfactor.

5.2.1 Long-term Vision With Dual Focus influences Coordination of Work Tasks

The long-term vision affects the technical decision made by the company. The case company aims to have a standardized way of working and the same coding language throughout the company which allows for greater flexibility among resources. The AV and the platform compete for the same resources, software engineers. If there is a decision made to prioritize either of them, these resources can be moved there, for example allocating all resources to the platform to accelerate the integration of new customers. This ability to move people between the teams can enhance scaling if the prioritization is anchored in the long-term vision. Although, there is a risk of losing specialization among the employees as they need to re-focus and be integrated into other teams if moved. Further, causing a need to allocate resources for integration of the new role.

5.2.2 Technical Readiness influences Customer Education

Bringing new innovation to the market often means that it will continue to develop after receiving input from the market. Further, customers need to be educated about the new technology they are about to adopt. Road traffic safety and ethical perspectives are two factors that affect the acceptance of autonomous road mobility among customers (Shabanpour et al., 2017). The fact that the technology is not yet ready for full commercialization makes it difficult to answer customer questions, complicating the selling process and explanation of the offer to the customer. The market penetration rate of autonomous road mobility within 25 years may vary from 20% to 95% (Simpson et al., 2019). One reason for this large variation is the uncertainty in the improvement of autonomous technology over time. The disability to predict future technology development increases the complexity of explaining the technology to potential customers which arguably will hamper the scaling.

5.2.3 Technical Readiness influences Lobby Work

In connection to the above discussion, technical readiness also influences lobby work. The more technically ready, the more proof of concept and opportunity for the company to showcase that the technology works and how it works. This can be used to build trust in the technology and showcase market value, with the purpose to influence legislators and other governmental instances to establish or adopt legislation to be applicable to autonomous road mobility. This will affect scalability positively.

5.2.4 Technical Readiness influences Coordination of Work Tasks

Technical readiness does not only influence the technology. The more technically ready the AVs become, the more specialized the tasks become. Currently, operations and commercial teams rely heavily on technical teams as knowledge is still being spread in the company. As technology reaches higher readiness it is expected that knowledge will be more spread internally, which means that operations and sales teams can work more independently. This frees up resources within the technical teams that can be used for other more value-adding tasks, and allows for more specialization within teams, which increases scalability.

5.2.5 Brand Recognition influences Talent Management

Great company branding does not only affect customer opportunities and appeal to investors, it also attracts potential employees. For a scale-up, attracting talents is often difficult, and being able to leverage the company brand for employer branding is a significant advantage and utilizes resources efficiently. This is favourable for scaling, both as talented employees are important to grow the scope, and to economize with resources. Retaining talent is also facilitated by a strong brand, as people are proud to work for a well-known company. On the other side, mentioned in the interviews was that employees might want to leverage on their resume while they are sure they can. This was not brought up in the reviewed literature and was not expected. This shows the backside of creating a strong brand combined with the uncertainties around a scale-up, and losing experienced employees, by any cause, will if not hinder scaling, at least become a hiccup.

5.2.6 Customer Education influences Lobby Work

In the same way that customers need the education to be willing to try and adopt new technology, legislators also need the education to form an interest in the new technology to start the process of updating legislation to be suitable for it. Lobbying from companies involved in the technology and industry organizations is important to draw attention to the technology. Nevertheless, these are not the only crucial actors. The more customers are educated and interested in the success of the technology, the more they can push for its commercialization and thereby help with lobby work. This could speed up the legislative processes within the area of autonomous technology and lead to a more positive outcome of lobby work, which would support the scaling of the company.

5.2.7 Existing Market Structure influences Locate Experience With Scale-up Mindset

Mentioned in the interviews was that candidates originating from the areas of logistics and supply chain management are hired to complement current sales and operations teams. This, to add experience to understand customers more thoroughly. This adds to the aforementioned complexity of hiring experience with a

scale-up mindset. Not only is it hard to locate experience from vehicle manufacturers with a scale-up mindset. It could likewise potentially be difficult to integrate logistics-experienced people that are used to the existing market structure. That could possibly negatively influence the work the company is doing to change the market structure. This would not be beneficial for scaling, as it would slow down the transformation necessary to integrate their offer in the market.

6
Conclusion

The purpose of this thesis was to provide knowledge about scale-up companies working with technology innovations in autonomous mobility and how these can facilitate the international scaling process. This was done by attempting to answer the following research question:

How do the factors Legal Frameworks, Complementary Technologies, Customers, and Teams affect international business model scaling for a scale-up company working with technology innovations in autonomous road mobility?

The factors *Legal Frameworks* and *Customers* affects the scaling process mainly negatively, mostly because these factors include aspects that are difficult for a company to single-handedly influence. The novelty of the technology is the root cause of the complicating aspects. This also causes the diversion of employees' time from further developing the technology and business, towards adapting to and influencing legislation and educating potential customers. The impact on scalability of these actions in the future is unpredictable. The other two factors, *Complementary Technologies* and *Teams* mainly affect the scalability positively long-term, and the scale-up has larger opportunities to control these effects. Furthermore, the results of a company's actions to influence scalability are more predictable. From all factors, *Complementary Technologies* was the one influencing most other factors, as 4 of the 7 interrelated factor findings were connected to *Complementary Technologies* affecting other factors. The influence mostly increased already positive effects on scalability or mitigated negative effects. Contrary, the factor *Teams* was the factor that was mostly influenced by other factors, and the scalability is affected both positively and negatively.

The findings further made it possible to identify how the four factors would affect the organization and the technology of a scale-up that is currently scaling. In conclusion, 12 of the 14 subfactors clearly affected the organization. 4 of them in a direct positive way, and 3 in a direct negative way. The remaining 5 affected the organization in a more neutral way or could not be determined. Furthermore, 10 subfactors clearly affected the technology. 5 of them in a direct positive way, and 2 of them in a direct negative way. The remaining 3 affected the technology in a more neutral way or could not be determined. In summary, the organization was slightly more affected by the factors than the technology, while the technology was more positively affected by the factors than the organization. This implies that more attention should be brought to how the factors affect the organization of a scaling

company to be aware of potential negative consequences and be able to mitigate them.

In conclusion, all four factors affect scalability, and scale-ups do have the opportunity to influence *how* to a variable extent. As the factors *Legal Frameworks* and *Customers* are impacted by a network of external parties to a greater extent than the other two factors, these are the most difficult to directly influence. Thereby, their impact on scalability is more complex to direct and predict. However, the factors *Complementary Technologies* and *Teams* are easier to influence internally. Hence, these factors mostly affect scalability positively if the scale-up within autonomous road mobility succeed with their actions to counteract the negative effects. If scale-ups within autonomous road mobility manage to utilize the positive influences of these four factors and successfully commercialize, they will have the possibility to positively impact the environment and boost the economy, which is beneficial for society as a whole.

Finally, a parallel could be drawn to scale-ups working with other technology innovations than autonomous road mobility. The findings from the four factors could potentially be applicable to them as well. Especially if these technology innovations have their origin in large and mature industries similar to the automotive industry. The issues of the factor legal frameworks are the difficulties of applying legislation that is not adapted to the new technological developments and adapting to differences in legislation internationally. These issues are not unique to autonomous road mobility but can be found for other technology innovations due to the nature of the legislation. Similarly, lobby work is an important strategy to educate legislators and build awareness regardless of the type of technology innovation. The factor complementary technologies may be the least applicable factor as it focuses on technologies that enable the existence of each other and are mutually reliant on each other. In a more general context of technology innovations, the theory of innovation ecosystem and complementary assets is still applicable. Almost all innovations needs a complementary asset to be utilized together with it to be successfully commercialized. The development of such assets can be done both internally, as in the case investigated in this thesis, or externally in an innovation ecosystem. The issues with the technology continuously developing and the complementing relation between the asset and the technology will still be present although the asset is externally developed. However, the potential issues with handling the duality in the company's long-term focus will not be the same. The customer factor can easily be applicable to companies looking to commercialize a technology innovation. The need to educate customers for them to be willing to adopt and building a strong brand with the assistance of the new technology is not unique to autonomous road mobility. Although, issues with a rigid existing market structure may differ due to the specific context of the logistics industry. The findings regarding the factor Teams can also easily be applied to scale-ups working with other technology innovations, as the findings mainly related to the scale-up environment. The context of technology innovations originating in a mature industry is however important to be able to apply the issues of locating experienced employees with a scale-up mindset.

6.1 Factors

The following paragraphs conclude how each separate factor affects international business model scalability. The findings were analyzed to identify if the factors affected scaling positively or negatively in the long-term with the assumption that the company would succeed with their efforts to increase scalability.

Legal Frameworks
Legislation was found to be a source of uncertainty. As anticipated, the current legal frameworks related to road mobility are not aligned with autonomous driving, and international legislation is fragmented. Identified challenges that will restrict scalability are concentrated around how legislation limits the number of potential use-cases and the difficulty to comply with future legislation due to the uncertainty of its development. These challenges are found to decrease a company's scalability, as they hinder commercialization, and introduces risk in technology development. They further divert employees' time and resources from technology development towards understanding, complying with, and influencing future legislation. It was found that differences in legislation internationally exponentially increase these difficulties.

Diverging somewhat from previous literature was the finding that influencing legislation on an international level is more helpful for scaling the company than adapting the business model to each country's legislation. This due to the novelty of the technology and that legislation is changing. The positive effects of national lobby work were however found to be mitigated as national legislators are obligated to follow international legislation from the UN and the EU. Instead, international lobby work was found to be a solution to some of the difficulties around the lack of alignment between legislation and technology and international legal inconsistencies and thereby moderate the negative effects they have on scalability, even though the time commitment might hamper scaling short-term. As a result, it appears that common legislation at EU- or UN-level would support international scaling the most.

Complementary Technologies
Multiple complementary technologies increase the total customer value, although they cause some challenges in strategic long-term decisions. This thesis found that a scale-up developing multiple complementary technologies benefit from the technologies complementing each other. Internally developing and integrating multiple technologies in the customer offer generates several positive impacts on the scaling process. The possibility to commercialize one of the technologies, while continuing to develop the other, generates revenue and allows for the collection of customer data that can be used for further development of both technologies. Furthermore, strategic decisions need to be based on the long-term vision of both technologies to reach future success with the scaling process, even if some decisions can seem wise for scalability looking only at the short term. One example of such a strate-

gic decision is to balance investments in the technologies. This to not risk either not fulfilling customer needs or lagging behind competitors by underinvesting, or overshooting demand by overinvesting, which both are found to hamper scaling. The level of technical readiness creates uncertainties in the scaling process, and the key is to identify when a rapidly developing technology is ready enough for commercialization, as continuously postponing it will hinder scaling. Further, scaling internationally increases the complexity of the technology and therefore negatively affect scalability. As the technologies play a central role for a company working with technology innovations in autonomous road mobility, it is not surprising that they affect the scalability of other areas.

Customers
Current and potential future customers, the brand and the market was found to highly influence the scalability of a company working with autonomous road mobility. The customers' adoption rate of the technology innovation means increasing the number of customers and thereby increasing scale. The fact that autonomous road mobility is a novel area requires customers to be educated for them to adopt the new technology, which requires plenty of resources, that short-term decreases the scalability as resources are deflected from directly value-adding activities. Road traffic safety and ethical perspectives were found to be the most important aspects for the acceptance of autonomous road mobility. Success in educating customers will accelerate adoption and enhance scalability. Further, scaling internationally adds challenges in the educational process as cultural differences and language barriers increase the complexity of communication. The novelty of the technology was also found to help to build a strong brand, which in turn increases the possibilities to attract customers and potential employees, increase customer knowledge, and work as a long-term competitive advantage. These effects will increase scalability. Findings further showed that the current customers interested in autonomous road mobility are early adopters. Facilitating the adoption of the technology by current customers by catering to their needs generates the risk of not being attractive to the majority as these have other needs, slowing down adoption and hampering scaling. Further, the existing market structure has the potential to negatively impact the scaling process, as business models including autonomous road mobility does not entirely fit that structure in terms of for example billing structure and value chain. This can create resistance among adopters which requires resources to overcome.

Teams
The building and management of high-performing teams were found to be a balancing act between decisions that either enhance scalability in the short-term or the long-term, difficulties that increase with the growth of the company. One example is the prioritization between recruiting quality or quantity. Both have negative consequences on scaling if exaggerated. Further, the introduction of employees with domain experience from large multinational corporations into the scale-up culture was detected to be complex and could affect scalability in both ways. These employees are important to guide technical decisions and introduce leadership, but can also be too path-dependent to their prior experience, which can counteract novel

ideas. Appropriate integration of new employees was found to be a key to increase the teams' potential and unlock the characteristics of scalability where the increase in output outpaces the increase in added resources. Furthermore, the growth of a company introduces the need for coordination of work and a clearer structure, as well as increasing internal struggle to adapt to the new organization. Difficulties of communication arise, and these grow exponentially with the increased number of employees. As communication is the base for coordination, it is important to address these challenges, as proper coordination of work tasks wisely utilizes resources at hand and thereby facilitates scaling. Moreover, the lack of structure was found to be negative for scale-ups scalability, and employees that are unable to adapt to the structure will increase that negative effect.

6.2 Future Research

As previously mentioned, current research with a focus on how business models could help the commercialization of autonomous road mobility is limited. As technology is rapidly evolving, the role the business model has in facilitating commercialization needs to be further understood. Therefore, future research in this area, in general, is suggested. Further, as this thesis is a single-case study, its limitations are acknowledged, arguably affecting the generalizability of the results. Therefore, it would be beneficial to do further research by expanding the research scope, looking at additional companies working with technology innovation in the area of autonomous road mobility and investigating how these four factors affect international business model scaling.

Future research could also investigate how additional factors, other than the four studied in this thesis, affect international business model scaling. The model by Stampfl et al. (2013) includes additional factors affecting business model scalability, that were not investigated in this thesis. These could be subject to further research and put in the context of autonomous road mobility to possibly give further insights on the scalability of business models within this area.

The complementary technologies are of different natures, one software and one hardware. They, therefore, qualifies into two different ends of the scalability continuum described by Hallowell (2001). The effects this phenomenon has on scalability is still unknown as the case company of this thesis is still at an early phase in their scaling journey and can therefore not act as a reference case regarding this question. There is still too little knowledge about how having complementary products on each side of the scalability continuum affects the scaling process. Hence it is suggested that further research is done in this area.

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A

Appendix 1

A.1 Levels of Automation

As the automation of vehicles can be more or less complex, a common point of reference for autonomous vehicles was presented by the global association SAE International. It defines six levels, 0-5, stretching from no automation to full automation to facilitate coordination. In level 0-2 the human driver monitors the driving, and for level 3-5 that task is done by the automated driving system. The dynamic driving task comprises both operational and tactical tasks, like regulating the speed (accelerating/breaking), steering, change lanes, responding to external events and using signals, but not the strategic tasks like routing. They are also separated by the system capability in different driving modes depending on the environmental conditions like heavy rain or fog, and other aspects like the type of road (highway, rural, urban, etc.) ("Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles", 2018).

1. **Level 0:** No automation. The human driver is in control over and performs all driving tasks
2. **Level 1:** Driver Assistance. The human driver is in control over all driving tasks and performs most of them. Can be assisted by either steering or speed regulation.
3. **Level 2:** Partial Automation. The human driver is in control over all driving tasks and performs most of them. May be assisted by one or more driver assistance systems regarding both steering and speed regulation.
4. **Level 3:** Conditional Automation. The automated driving system executes all the dynamic driving tasks under specific environmental aspects, but the human driver needs to be able to take over the control upon request.
5. **Level 4:** High Automation. The automated driving system executes all the dynamic driving tasks under specific environmental aspects and does not need a human to respond to a request of control when under the specific environmental aspects. If there is a change in the environmental conditions, the human driver may need to step in.
6. **Level 5:** Full Automation. The automated driving system executes all the dynamic driving tasks full-time under all types of environmental aspects and does not need a human driver.

B

Appendix 2

B.1 Current Developments in the Area of Legislation

The newest development within legislation regarding AVs is the draft law that the German Federal Government adopted in February 2021 and is planned to come into force in 2021 (Bundesministerium für Verkehr und digitale Infrastruktur, no date). To ensure agreement with the Vienna Convention, a "technical supervisor" is responsible for the vehicle and compliance to road traffic law and ensuring road safety (Simmons & Simmons, 2021). Upon adoption, Germany would be the first country globally to allow highly AVs (level 4) in regular operation on public roads for a specific set of scenarios, and level 5 is intended to be included after further development of the legal framework (Bundesministerium für Verkehr und digitale Infrastruktur, no date). The most important operational scenarios for this context are shuttle transports, driverless connections between logistic centers, and demand-oriented transport services at off-peak times in rural areas. To obtain an operating permit, there are technical requirements that need to be met, mainly regarding road safety, securing wireless connection, and the possibility of remote control. Further the law states obligations for manufacturers, which, among other obligations, includes the security against cybercrimes, sufficient and secure wireless connection, and offering training for operators of the vehicle. (Simmons & Simmons, 2021). The law also includes regulations on data storage and protection, as well as regulations on accident prevention (Simmons & Simmons, 2021), but lacks to fully resolve liability issues.

The law is intended to be an interim solution and complement current road traffic law to incorporate autonomous driving in Germany and will apply until EU or international laws prevail it (Bundesministerium für Verkehr und digitale Infrastruktur, no date). Due to the size and influence of the German automotive industry in the EU, it is possible that this law will serve as a foundation for future harmonized EU regulations.

Interesting to note is that current EU legislation considers the system of an AV that has been part of a road traffic accident as malfunctioning (Taeihagh and Lim, 2019), as they are expected to calculate all possible parameters to avoid accidents. This is a utopian view of autonomous road mobility, and road accidents will still happen (Coca-Vila, 2018). Even more interesting is the fact that the PLD only relates to

hardware issues, not providing any guidance for software issues (Dima, 2019). National courts of the member states struggle with whether a software can be defined as a product or not (Engelhard de Bruin, 2017), and thereby if the producer can be held liable for any damages/injuries caused by software malfunctions.

B.2 EU Legislation

The basis for the objectives of the EU are found in the treaties, which all members have ratified. This means that the EU can only adopt legislation that conforms with the treaties. (European Union, no date-a). There are five types of EU laws, and these are applied nationally in different ways. The two most important in this context are the "regulations" and the "directives". Both are mandatory, but the main difference is that the regulation applies automatically in the same way in all member states, and directives lets the member states choose a way to reach a goal within two years. (European Union, no date-b).

Under present liability legislation in the EU, there are two scenarios of liability. Either an accident is caused by the driver due to careless behavior or not abiding to road traffic rules (Dima, 2019), or it is due to a failure of the hardware (Evas et al., 2018). These are regulated by the Product Liability Directive (PLD) and the Motor Insurance Directive (MID). To sell and use products in the EU, manufacturers need to follow the minimum requirements of safety and data protection etc. stated in the PLD. (Dima, 2019). The PLD also states that "the producer shall be liable for damage caused by a defect in his product" (European Commission, 1985). In addition, there are some variations between member states and other European countries. In, for instance, the UK and Malta, fault-based liability is applied, meaning that the user or owner of the vehicle must be aware of the issue and could have avoided it to be held liable. Other countries apply risk-based liability. Fault-based liability is hard to apply to level 5 AVs without a driver. (Dima, 2019). Differentiating from other European countries are Germany and the Netherlands where the owner of an AV can avoid liability if an external cause of the accident can be found (Taeihagh and Lim, 2019).

B.3 Setting up Businesses and Working Within the EU/Schengen

With international expansion legal issues concerning operating abroad follow. Thankfully, this is not very complicated within the EU. Every EU citizen has the right to establish a company, or a subsidiary of an already existing company, in every EU member state, Norway, Lichtenstein, and Iceland (European Union, 2021b). An alternative option is to set up a European Company, is a public limited-liability company that can be used when a company has presence in multiple EU countries (European Union, 2021a). If the company does not want to set up a new legal

company abroad, companies are allowed to do temporary business, case-to-case, in other EU companies ("The Treaty on the Functioning of the European Union", 1957). One of the foundation pillars of the European Union is the free movement of both goods and people, ruled by the Treaty on the Functioning of the European Union. The freedom of goods facilitates offering a company's products abroad, without being subject to discrimination, quota systems or rigorous importing/exporting procedures. This further enables companies to displace workers temporarily to do temporary work in another member state as a "posted worker". ("The Treaty on the Functioning of the European Union", 1957). There are in addition also no internal borders for goods and people within Schengen.

Chapter 5, article 90, of the "The Treaty on the Functioning of the European Union" (1957) refers to a regulation that regulates how transport between member states should be carried out. Especially important in this context is to follow the conditions where non-resident carriers may operate within a member state. These include following technical standards, requirements regarding weight and dimensions, carrying a Community License on board, etc.(European Commission, 1997).

C

Appendix 3

C.1 Internationalization

The Uppsala Model
Early literature on multinational firms focuses mostly on large, well-established firms (Chandler, 1986). Internationalizing incrementally is the foundation of the *Uppsala Model* (Johanson and Vahlne, 1977). Johanson and Vahlne (1977) describe the decision process to internationalize as successive, meaning that it is a collection of small incremental decisions that lead to internationalization. The incremental nature of this process makes it rather slow and it is often initialized late in the company's development. From this incremental decision-making, Johanson and Vahlne (1977) formulates a model that takes all previous decisions and events in the company as input for the next. The model, called the *Uppsala Model*, is based on the underlying issue of uncertainty and that the internationalization process is about navigating through it. Decreased uncertainty will incrementally increase the international involvement. (Johanson and Vahlne, 1977). The incremental decision-making process is explained by Forsgren (2002) as "learning by doing" which can be summarized as increased knowledge about the market decreases the perceived market risk, leading to increased engagement and level of international investment in that market.

Johanson and Vahlne (1977)'s basic assumption is that lack of market knowledge will be an obstacle for the internationalization process and that this knowledge can mainly be acquired by establishing operations abroad. Increased market knowledge leads to decisions to commit to the market (Johanson and Vahlne, 1977). The increased commitment means that the company becomes more closely connected to the country as resources are more or less locked to that specific market. The Uppsala Model by Johanson and Vahlne (1977) is based on the underlying idea that companies are risk-minimizing and long-term profit-maximizing. The internationalization decision will be based on whether the current market risk in a foreign market is lower than the maximum tolerable market risk. The current market risk is fluctuating with market commitment and market uncertainty. Uncertainty-reducing commitments will be made when the current risk is bigger than the maximum tolerable risk, leading to increased interaction with the market to reduce the risk. In conclusion, scale will be made step-wise based on market experience and by observing and analyzing previous commitments. Further, the overall growth of the market will speed up the process. (Johanson and Vahlne, 1977).

There are two main factors in the Uppsala model that affects the internationalization process; state and change. The state factor is described as the present state of the company in the internationalization process which then helps to explain the following course of the internationalization. The state aspects are *market knowledge* and *market commitment*. Market knowledge concerns what is known about the foreign market and market commitment involves the number of resources that are country specific and cannot be transferred to another country. The state aspects affects the change aspects which are *commitment decisions* and performance of *current activities*. These aspects takes the company from one stage to another, see list above. The change aspects in turn affects the state aspects. (Johanson and Vahlne, 1977).

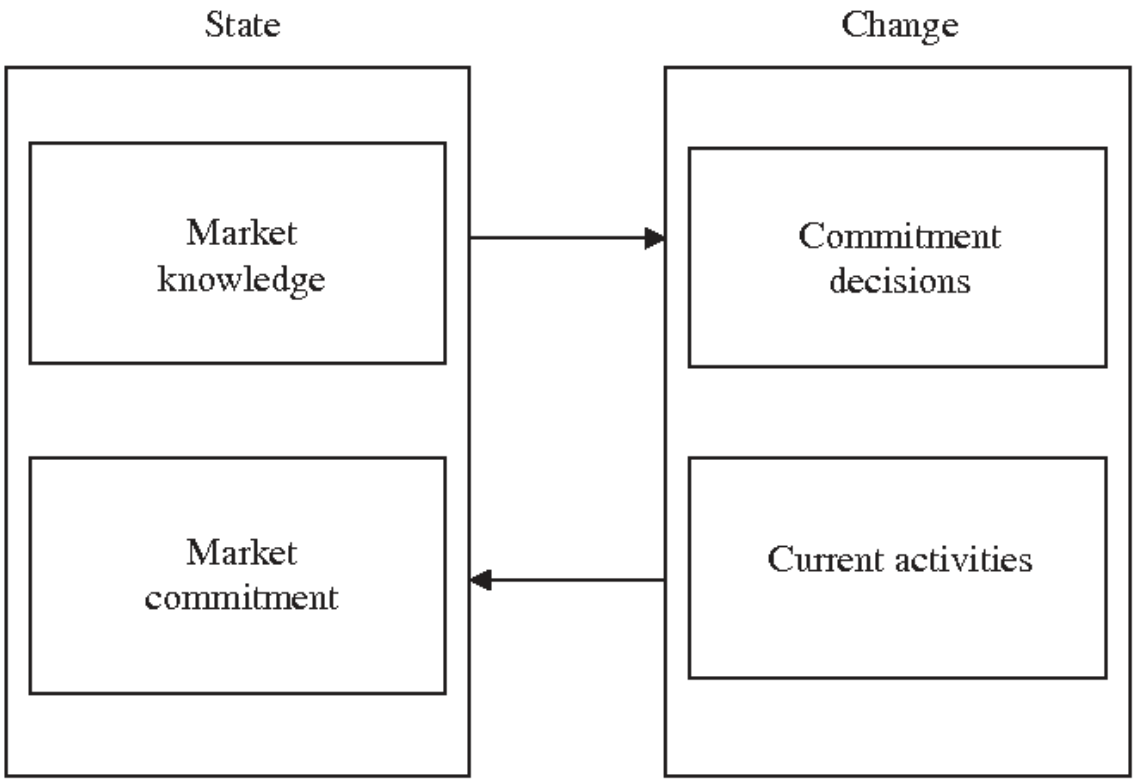

Figure C.1: The Uppsala Model, (Johanson and Vahlne, 1977)

Johanson and Vahlne (1977) research showed that Swedish companies often establish abroad in small steps. The journey to become fully internationalized on a specific market starts at stage one and ends at stage four (Johanson and Wiedersheim-Paul, 1975):

1. No continuous export activities,
2. Export activities via independent representatives (agents),
3. Establishment of overseas sales subsidiary
4. Foreign production/manufacturing.

As mentioned the model is widely known and has therefore also been reviewed.

The founders of the Uppsala Model themselves Johanson and Vahlne (1990) suggest that more research needs to be done on the surroundings of the internationalization process, for example on networks. More recent literature challenge this view of an international firm and shed light on younger and smaller companies that internationalize (Oviatt and McDougall, 1994). Oviatt and McDougall (1994) explores the concept of *International New Ventures* who neither live up to the level of establishment nor incremental internationalization process as stated by Johanson and Vahlne (1977).

The Network Model
Coviello and Munro (1997) found that network relations affect the internationalization decision and mode of entry on a foreign market. In line with, Johanson and Mattsson (1987) who concluded that a network approach is appropriate when studying possible actions a firm can take when it examines strategies and actions in different markets. Continuing on the network approach Coviello and Munro (1997) investigated small software firms' internationalization process and found that this process advanced at a higher pace than what could be expected with reference to the Uppsala Model. The *Network Theory* was then developed and based on the integration of the incremental internationalization process and the network concept. Stepping away from the stage-wise perspective it is discovered that internationalization is driven, inhibited and facilitated by formal and informal network relationships. These relationships are what first selects what market to enter and then the mode of entry. A firm's strategy emerges from network relationships as a pattern of behaviors from different parties. The parties within the network prefer the relationship rather than individual transactions, enhancing a minimized and controlled opportunistic behavior. (Coviello and Munro, 1997). Coviello and Munro (1997) recognized a pattern of small software firms externalizing some activities while internationalising, relying on international network relationships for market selection and mode of entry.

Coviello and Munro (1997) recognized a pattern of small software firms externalizing some activities while internationalising, relying on international network relationships for market selection and mode of entry. The authors created a framework that maps international expansion of these firms. The framework consists of three steps. (Coviello and Munro, 1997).

1. Foreign Market Intention - begins their domestic focus and establish initial relationships
2. Active Involvement and Evaluation - enters first foreign, although physically close, market and establish initial network partners
3. Committed Involvement - establish formal and informal relationships across networks

Coviello and Munro (1997) describes the following differences from the view of internationalization through the Uppsala Model (Coviello and Munro, 1997, p.379):

1. it is very rapid, with firms becoming established and committed internationalists in as little as three years;
2. it is characterised by only three "stages," beginning with foreign market intention, and excluding extensive foreign market trial, experimentation, or evaluation;
3. it is characterised by the small firms making simultaneous use of multiple and different modes of entry; mechanisms which are part of a larger firm's international network

The applicability of the Network Model on bigger firms is questionable due to limited research in that area. Hence Johanson and Vahlne (2009) revisited their previously formulated model and now views the business environment as a web of relationships, a network, in line with Coviello and Munro (1997). The firm's business network includes parties that engage in several interdependent relationships. The authors renewed their perspective of independent suppliers and customers on a neoclassical market, and suggest additional change mechanisms, trust-building and knowledge creation, to their model. Knowledge creation refers to knowledge that evolves within relationships. (Johanson and Vahlne, 2009)

D
Appendix 4

D.1 Business Models

As earlier explained, governments believe that start-ups are beneficial for regional economic growth and focus resources on supporting the starting of new ventures (Davila et al., 2010). It is also a way to address problems if widening income gaps and indirectly stimulate innovation and productivity by forcing other firms to invest (OECD, 2018). However, governments often ignore the difficulties start-ups have as they start to scale and fail to support this transition (Davila et al., 2010). Scaling may occur directly after the start-up but is possible throughout the firm's lifetime. Reasons to scale could possibly be to manage a major demand increase, capture new opportunities, or improve the competitive position.

The OECD uses the notion high-growth firms, which the European Commission uses interchangeably with scale-up firm, as do we. These are firms that over a short period of time grow rapidly with potential to secure future growth in profits. According to the OECD (2018), scale-ups often represent a small portion of the total economy, but account for a larger portion of employment. Scale-ups have higher productivity growth, and indirectly contribute to general productivity growth as they cause knowledge spillovers which other firms can make use of.

Even though the exact parts of a business model are not defined, there are few pieces that regularly recur. One of them is the identification of the users and the customers, and which actor that will be paying (Teece, 2010). Secondly, identifying the value proposition for each target customer group is also frequently mentioned, as well is the value delivery, and lastly also how the firm captures value (Baden-Fuller and Haefliger, 2013).

D.2 An Explorative Model of Business Model Scalability

The model consists of five mutually exclusive factors that influence the scalability of business models through conceptualization. Additionally, two moderating factors are presented that can enhance or moderate the effect of the business model in the realization stage. These seven factors influence the success of the two possible outcomes that also internally influence each other, investor attractiveness and company

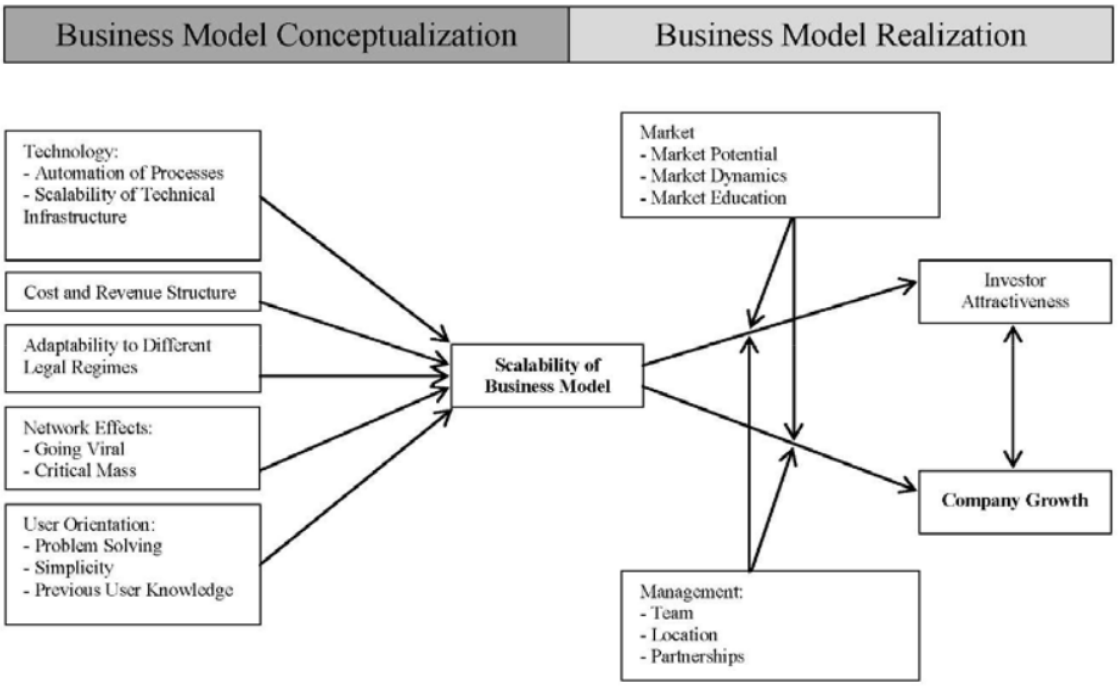

Figure D.1: An explorative model of business model scalability, (Stampfl, Prügl, and Osterloh, 2013)

growth.

The five factors influencing business model conceptualization are:

1. Technology
   Proper use of technology significantly influences the scalability of a business model and is often times the part that enables scalability. It encompasses automation of processes to reduce fixed costs as well as the scalability of technical infrastructure to support more users without loss in quality.

2. Cost and revenue structure
   It has proved difficult to only rely on internally generated revenues and cash flows to support fast paced growth, as growth is costly. To avoid letting financing obstruct growth, there are ways to gain financing through investments, and investors prefer businesses that generate revenues early on, and have limited fixed costs. The cost and revenue structures are therefore important to consider wisely.

3. Adaptability to different legal regimes
   If a business model only needs small adaptations to work abroad, under different legal regimes, it will significantly increase scalability. Legal restrictions can inhibit international operations, and if the business model has not taken this into account, it will either prevent the business to grow within certain countries or need considerable extra work to adapt. Geographical expansion can thus become both constraining and expensive.

4. Network effects
   Network effects can work both in favor or against the scalability of a business. These effects will exponentially increase or decrease the number of users of a network. This is a consequence of value for one single user fluctuating in relation to the number of other users. The size of the user base is positively influencing the scalability of the business model.

5. User orientation
   The model highlights the importance of keeping customers and their wishes central and focusing efforts on solving existing problems (technology pull). This in contrast to a technology push. This requires user knowledge and problem solving. The number of users with a problem positively influences the scalability, as does the simplicity of the solution.

Beyond these five factors, Stampfl et al. (2013) also introduce moderators that will affect the success of the conceptualization of a scalable business model. The idea is that identical business models will have different outcomes depending both on the specific environment and the execution. Thus, the market and management are the two moderating factors.

1. Market
   It is well researched that market attributes have impact on the growth of firms (eg. McDougall, Covin, Robinson Jr, and Herron, 1994). The market potential of the target market segment is an important influence on growth, the bigger the volume, the likelier for the firm to grow rapidly. Market dynamics are also affecting success but can be insidious. It is necessary to ensure that the timing of the business model realization is aligned with the market. If the market is changing quickly and is highly dynamic, the business model will reach full potential quickly, and then become obsolete as the market changes again. Therefore, it is important to grow along with the market dynamics. Lastly, market education and complexity of the offer is highlighted, both to have inhibiting and supportive effect. Difficulties to enter a market arise when potential customers need to be educated to understand the offer and why they need it. This requires investments which hinders scalability. On the other hand, if the market is in need of education, fast followers can draw advantage if a pioneering firm has laid the groundwork.

2. Management
   This factor includes most parts of the organizational structure of how the firm is organized and run, but focuses mainly on the employees of the team, the location where the firm operates, and the partnerships employed. The team is viewed as the base of scalability, and their experience and the communication internally are important for growth. As many successful startups originate from the same geographical locations, eg. Silicon Valley and London, the environment is considered important. Firms are dependent on the

access of resources in their local environment. Finally, decisions regarding business partnerships and investor partnerships also influence the outcome of the business model. Stampfl et al. (2013) does not explicitly mention the internal processes and the need for change in management along with growth, but these are frequently mentioned in adjacent literature (eg. Davila et al., 2010; Greiner, 2018).

E

Appendix 5

E.1 Interview Questions - Legal Frameworks

Four different templates were used, depending on the focus of the interview.
Introduction

1. What is your role at the company, what are your work tasks?
2. For how long have you been with the company?
3. What do you view as the company's company vision with regards to the offering?
4. Do you view the AV or the platform as the main offer?
5. Looking at the different teams, are they all working with the AV/platform (depending on answer a.) as the main offer?

Factor-specific questions - Legal Frameworks

1. What laws and regulations affect the company's offer and business today?
2. What are the pros and cons of having joint laws on a high level (EU/UN) vs. the national level?
3. How do you think legislation will affect the company's business on a time horizon of 2 years? 5 years?
4. What does the company need to do or take responsibility for to facilitate the AT part of the business?
5. Do you think the company should find loopholes in the existing regulations, lobbying or try to affect the regulations directly?
6. Is national legislation regarding autonomous vehicles a part of the decision when it comes to international expansion?
7. Currently, at EU-level, a producer can only be held liable for accidents that are caused by a failure of hardware, and not software. Is this something that affects the company?
8. Do you know anyone else that could be able to answer these questions?

General questions about the three remaining factors

Complementary Technologies

1. Do you see any internal trade-offs between the platform and the AV resource-wise?

   (a) If yes, which?
   (b) If no, why?
2. Are you affected by the fact that the company is working with both autonomous trucks and the platform in your daily work?
   (a) If not now, in the future?

Customers

1. Do you think about who the company's customers are while you work?
2. Does your view of the company's customers affect your daily work?

Teams

1. Do you have a clear job description?
2. Do you see any potential overlaps between different teams?
3. Does your job match your job description?
4. Do you work with the tasks you were hired to do?
   (a) If no: have you ever done so?
   (b) If yes: Have your work tasks changed since you started? How has that affected you?
5. How is the work in your team affected when it grows with new employees?

E.2 Interview Questions - Complementary Technologies

Introduction

1. What is your role at the company, what are your work tasks?
2. For how long have you been with the company?
3. What do you view as the company's company vision with regards to the offering?
4. Do you view the AV or the platform as the main offer?
5. Looking at the different teams, are they all working with the AV/platform (depending on answer a.) as the main offer?

Factor-specific questions - Complementary Technologies

1. In what ways do you think the AV and the platform cooperate to increase the company's potential to grow?
2. Do you see any trade-offs between the platform and the AV in general?
   (a) If yes, which?
   (b) If no, why not?
3. Do you see any problems with resource allocation between the platform and the AV?
4. How are decisions made regarding resource allocation between the two?

   (a) What is this decision based on?
5. Do you see any problems with expanding the customer base that uses the platform internationally?
6. Do you see any problems with increasing the number of AVs sold by the company?
7. Do you know anyone else that could be able to answer these questions?

General questions about the three remaining factors

Legal Frameworks

1. Are you affected by legal issues and limitations in your daily work?

Customers

1. Do you think about who the company's customers are while you work?
2. Does your view of the company's customers affect your daily work?

Teams

1. Do you have a clear job description?
2. Do you see any potential overlaps between different teams?
3. Does your job match your job description?
4. Do you work with the tasks you were hired to do?
   (a) If no: have you ever done so?
   (b) If yes: Have your work tasks changed since you started? How has that affected you?
5. How is the work in your team affected when it grows with new employees?

E.3 Interview Questions - Customers

Introduction

1. What is your role at the company, what are your work tasks?
2. For how long have you been with the company?
3. What do you view as the company's company vision with regards to the offering?
4. Do you view the AV or the platform as the main offer?
5. Looking at the different teams, are they all working with the AV/platform (depending on answer a.) as the main offer?

Factor-specific questions - Customers

1. What characteristics do your current customers have in common?
2. The customers that contact the company interested in the AV, what characteristics are common for them?

3. Do you experience that your customers have enough knowledge about autonomous mobility for your offer?
4. What are typical questions the customers have that you frequently need to answer?
5. What are the three most common objections to the company's offering?
6. According to theory of adoption of new technology, there is a gap between early customers and more mainstream/majority customers. From what we have understood, the company's current customers are the early customers. Do you see anything that needs to change with the offer or your processes to reach the mainstream customers?
7. Do you know anyone else that could be able to answer these questions?

General questions about the three remaining factors

Legal Frameworks

1. Are you affected by legal issues and limitations in your daily work?

Complementary Technologies

1. Do you see any internal trade-offs between the platform and the AV resource-wise?
   (a) If yes, which?
   (b) If no, why?
2. Are you affected by the fact that the company is working with both autonomous trucks and the platform in your daily work?
   (a) If not now, in the future?

Teams

1. Do you have a clear job description?
2. Do you see any potential overlaps between different teams?
3. Does your job match your job description?
4. Do you work with the tasks you were hired to do?
   (a) If no: have you ever done so?
   (b) If yes: Have your work tasks changed since you started? How has that affected you?
5. How is the work in your team affected when it grows with new employees?

E.4 Interview Questions - Teams

Introduction

1. What is your role at the company, what are your work tasks?
2. For how long have you been with the company?

3. What do you view as the company's company vision with regards to the offering?
4. Do you view the AV or the platform as the main offer?
5. Looking at the different teams, are they all working with the AV/platform (depending on answer a.) as the main offer?

Factor-specific questions - Teams

1. What are the biggest challenges in your daily work?
2. Are there challenges within the recruitment process correlated to the fact that the company is a scale-up?
3. Is there enough interest/demand to fill vacant spots in the company?
4. Which are the three areas of employment that are the hardest to find the right candidate for?
   (a) Why?
5. Autonomous vehicles and autonomous road mobility are novel for society. What are the pros or cons with this in the recruitment process?
6. Is it hard to find qualified people within these areas of employment?
7. What are the three biggest reasons for people to quit their jobs at the company?
8. When a company grows the area of assigned tasks to employees might change. Is it a problem for the company that people decide to quit when/if this happens? you know anyone else that could be able to answer these questions?

General questions about the three remaining factors

Legal Frameworks

1. Are you affected by legal issues and limitations in your daily work?

Complementary Technologies

1. Do you see any internal trade-offs between the platform and the AV resource-wise?
   (a) If yes, which?
   (b) If no, why?
2. Are you affected by the fact that the company is working with both autonomous trucks and the platform in your daily work?
   (a) If not now, in the future?

Customers

1. Do you think about who the company's customers are while you work?
2. Does your view of the company's customers affect your daily work?

F

Acronyms

AV - Autonomous Vehicles

GDPR - General Data Protection Regulation

OECD - The Organisation for Economic Co-operation and Development

SEP - The Startup Europe Partnership

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