CHALMERS
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Taking Innovation to Market

A case study exploring the relationship between competitive strategy, operations strategy, and business performance

Master's thesis in Master Programs MPMEI & MPQOM

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CHALMERS UNIVERSITY OF TECHNOLOGY
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Abstract

This master's thesis was written for an energy startup, referred to as the case company, who has an innovation that it is currently trying to take to market. The thesis analyzes how the choices the case company has already made with regards to its competitive strategy influences the choices it has in terms of its operations strategy as well as the subsequent impact of operations strategy on the case company's business performance. The analysis was performed by developing a conceptual model that built on and expanded relevant literature. Each individual component of the conceptual model was analyzed in terms of its impact and how this affected the set of available choices for the case company. The thesis also analyzed how the suitability of these decisions could change over time as both the industry and sales volume changes. The thesis concludes that for the case company several of the components of competitive strategy have a clear impact on operations strategy. Furthermore, there are several ways operations strategy can influence business performance. However, not all of these strategies are viable to pursue due to the already set competitive strategy.

Keywords: competitive strategy, operations strategy, business performance, startup.

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We would like to express our gratitude to two parties. Firstly, we would like to thank Hans Löfsten for his assistance and continuous feedback during the process of writing this thesis. His valuable insights greatly improved the overall structure and quality of the thesis and helped answer many our questions we had along the way. Secondly, we would like to thank the employees of the case company for allowing us to write this thesis for them and for contributing with resources and information that proved vital to the final version of this paper.

Tobias Roos & Samuel Ört, Gothenburg, May 2019

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1

Introduction

The following chapter will provide an introduction the thesis in terms of background, research problem, the aim and purpose of the thesis, proposed research question, demarcations as well as an outline of the thesis. Furthermore, the background aims to problematize the case company's situation into a set of research questions.

1.1 Background

According to Blank (2010), a startup is an organization formed to search for a repeatable and scalable business model. This definition emphasizes repeatability and scalability as crucial components for the survival of a startup making the transition from prototype to production. Further, Figure 1.1 shows a visualization of the stages of a startup as purposed by Blank (2010).

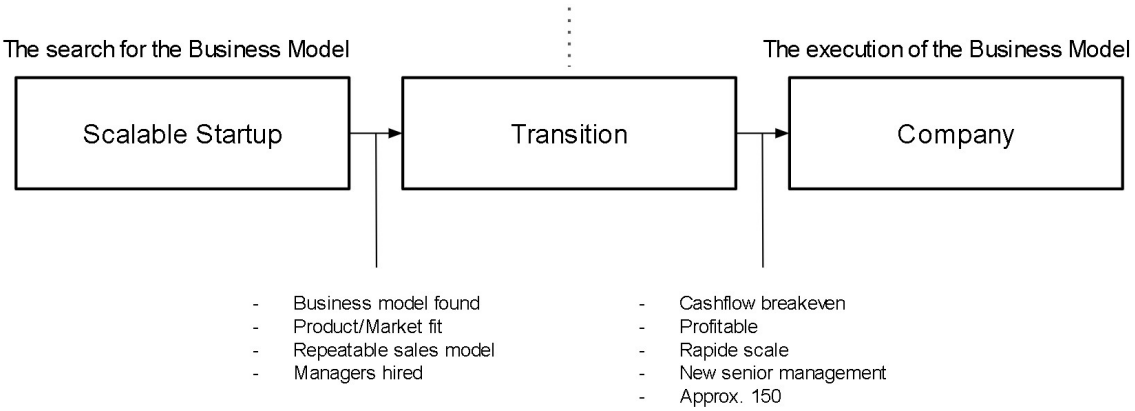


Figure 1.1: The stages of an startup company according to Blank (2010).

To better understand what defines a startup Sutton (2000) provides four characteristics (listed below) of what a startup is. The focus of these four characteristics is on software startups but applies to the studied case company as well.

- **Little or no history of operations**: The most basic characteristic of a startup company, they are young and established relatively recently.

- **Limited in terms of resources**: Another basic characteristic of a startup is the scarcity of resources.
- **Multiple influences**: The startup company typically experiences influences from a multitude of stakeholders.
- **Dynamic technologies and markets**: The startup company often operates within disruptive and changing industries.

Because of previous work by Wiman Ohlson and Montalvo Kai (2018) and the position of the case company, this thesis will place great emphasis on the second stage where the startup is beginning to transition into a full-scale company. The case company faces radically new challenges when starting to transition from *The search for the Business Model* to the *The execution of the Business Model*. For example, the case company will have to acquire material from reliable suppliers, see to company culture and place greater focus on profitability as well as cash flow. The thesis will therefore concentrate on how to move from the one phase to the next and what factors that will impact the case company the most in doing so.

1.1.1 Company profile

This thesis will focus on a startup, hereinafter referred to as the case company, which is trying to launch a product in the compressed air system (CAS) market. The case company was started as recently as 2017 with the primary purpose of commercializing the patented invention of the fluid flow converter (FFC) which in essence converts either rotation into a fluid flow or a fluid flow into a rotation (Ehrnberg, 2016). The innovation was tested and benchmarked against conventional solutions in 2016 which indicated a significantly higher efficiency which therefore increases its commercial potential. Furthermore, the case company is made up of three people; the inventor, a business developer, and a product developer, each of whom have either limited or no prior manufacturing experience. Hence, a fundamental complexity the case company faces is how to scale its operations and how to make decisions about where and how to manufacture its commercialized solution.

The case company is today backed by two local incubators investing capital in innovative ideas and startups. At the moment the case company is in an expansive phase developing and launching its first commercial pilot project. Also, there are several working prototypes in multiple sizes and configurations currently being evaluated and benchmarked in order to determine the efficiency and reliability.

The Fluid Flow Converter–seen in Figure 1.2–is made up of two separate coiled conduits as well as a separator which separates the first fluid from the second one. As the apparatus rotates the fluids of the first and second conduit is alternately transported from or to the separator, thus providing a flow through the apparatus. The apparatus can operate in mainly two modes; either providing rotational force by the pressure within the apparatus or providing a pressure of a fluid as a result of rotational force. The FFC can be considered a sizeable industrial apparatus since

it gains significantly in capacity with an increased diameter as a consequence of physical principles.

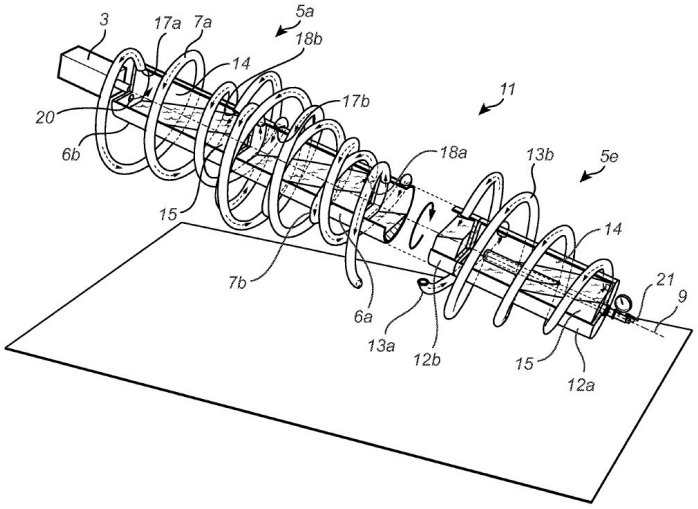


Figure 1.2: Illustration of the Fluid Flow Converter (Ehrnberg, 2016).

1.1.2 Industry profile

The industry of compressed air has a significant impact on various manufacturers since it can stand for the main part of the total electrical consumption and cost (Saidur et al., 2010, Mousavi et al., 2014, Dindorf, 2012). It is estimated that the energy consumption of CAS accounts for 10% of all industrially consumed energy within the EU (Saidur et al., 2010) as well as between 10% and 30% in the US (Mousavi et al., 2014). Moreover, compressed air is a commodity used in a wide variety of industries including food, textiles, apparel, chemicals, pharmaceuticals, and furniture to mention a few (Saidur et al., 2010) making it a crucial component for manufacturing firms globally. Thus the customer base of the case company is made up of any firm that uses compressed air in their manufacturing process.

Due to the significant energy costs tied to CAS current trends within the CAS industry include an increased focus on implementing more energy efficient CAS as an answer to lowering costs in order to improve profitability. Additionally, the increased focus on CAS is also due to firms need to reconfigure the business process to become more sustainable, both in terms of becoming more environmentally conscious as well a having a more long-term energy strategy. However, even though the implementation of more energy efficient CAS is supported economically as well as by sustainability factors there might exist barriers for implementation. These barriers include such as, economical–access to capital and investment costs, behavioral–inertia, values, and bounded rationality, and organizational with the most notable being economical (Nehler et al., 2018).

1.2 Aim

This thesis aims to explore the factors which influence the business performance of innovative companies when taking a product to market. Additionally, we aim to develop a conceptual model using a set of factors which could be applied by startups to help determine how decisions influence their business performance when taking an innovation to market.

1.3 Research problem

Startups, or more specifically small- and medium-sized enterprises (SME's) account for the majority of the total employment in society (de Kok et al., 2011, OECD, 2018*a*). SME's are generally defined as firms with fewer than 250 employees, although this varies by country, while small and micro enterprises generally having fewer than 50 and ten employees, respectively (OECD, 2005). Small and micro enterprises have the highest job growth rate, with micro enterprises in particular contributing 58% of total employment growth in the EU27 (de Kok et al., 2011). In particular, firms five years old or younger account for 21% of total employment but 47% of job creation. However, the majority of SME's either fail in the first years (de Kok et al., 2011, OECD, 2016) or remain small (OECD, 2016).

Startups face several challenges, including sales or customer acquisition, product development, and growth (Kollman et al., 2016). Securing customers is especially difficult since potential customers will assess the chances of the startup's survival before committing. Additionally, since startups do not have a track record for customers to go on they face the problem of search costs in which the first set of customers have to conduct their own tests and investigations. Finally, customers face switching costs in the form of administrative costs and the loss of relation-specific assets (Bhidé, 2003). Furthermore, SME's account for a significantly smaller proportion of employment and value added, largely due to increasing returns to scale and entry barriers (OECD, 2017), indicating that scaling is especially difficult in manufacturing.

An additional challenge that startups face is the competitiveness of its environment. According to PwC (2018), 2018 saw 14 274 venture capital-backed deals being made with a combined value of 51 billion USD invested in startups within different stages worldwide. The trend is clear; since 2013 the three major areas of startups, Europe, Asia, and North America, have seen an increase in the number of deals as well as the accumulated value invested on a yearly basis. Furthermore, the number of unicorns–a startup valued over one billion USD–per capita in the U.S. has since 2013 increased from 26 to 140 in 2018 (PwC, 2018), indicating increased competition in the environment and the business interest in startups. This is also supported by the number of exits worldwide which have increased considerably from 1217 in 2011 to 4228 in 2018 (Statista, 2019*b*).

Beyond the apparent dissimilarities between a company and a startup, there exists

differences between the two in how to achieve success. In the case of the startup, great emphasis is placed on the characteristics and behavior of the entrepreneur. For example, Groenewegen and Langen (2012) suggests that there are three main variables that determine the growth prospects of a startup, principally the unique advantage of radical innovation, the organizational characteristics, and the characteristics of the entrepreneur. Similarly, Duchesneau and Gartner (1990) suggests that the behavior and traits of the entrepreneur have an impact on the outcome of the startup. On the contrary, the existing knowledge and literature of how an established company should succeed places greater importance on achieving a competitive advantage through the means of strategy (Grant, 2016, Johnson et al., 2007).

Since the value of technology depends on the exploitation of it (Chesbrough, 2010), it is important for companies to have a business model that can capture the value of the technology. Similar to the notion of dominant design put forth by Utterback and Suarez (1995), it is not the innovation with the greatest technological performance that necessarily captures the greatest value. Rather it is the technical innovation that best balances the requirements and needs of several groups of users and stakeholders (Utterback and Suarez, 1995). Moreover, Afuah and Utterback (1997) argues that for every phase of the technological innovation there is a corresponding appropriate strategy. Hence, arguing that as the innovation evolves so should the strategy since the structural components of the industry also changes (Afuah and Utterback, 1997). Consequently, strategy is an integral part of any technology startup seeking to capture value within the market.

There is plenty of literature and research within the area of operations management and operations strategy, for example what type of production processes and layouts are suitable for a specific product configuration, as well as how to design the supply network (e.g. Slack et al. (2007), Abele et al. (2008)). It has been established that operations management and operations performance is vital for any organization and its performance (Slack et al., 2007). In fact, there exists a relationship between a company's competitive and manufacturing strategy and the impact on the company's performance with the competitive direction having an impact on the manufacturing strategy the business should pursue (Ward and Duray, 2000). For example, a company competing in the higher end requires more focus on reliability and high quality (Skinner, 1969). Consequently, there is a clear link between the company's competitive strategy in terms of positioning and its operational strategy.

However, most of the research appears to focus on larger companies and how these can best create an operations strategy to handle the phases of its product's life-cycles. For example, Abele et al. (2008) focuses on how companies can ramp-up production to full capacity, not how a company can transition from smaller to larger scale. Hence, it is of interest to research how smaller companies can create value and maximize business performance from their operations strategy.

The case company will likely face several of the more general problems outlined in the previous section when trying to scale. The combination of insufficient production capabilities and the product characteristics means that the scaling of the case

company's operations might prove particularly difficult. As the case company is hoping to sell and produce larger quantities in the upcoming years and since low unit costs are believed to be a critical component for the company's future success (Case company, unstructured interview, 2019-03-25b), it will need to design its operations so that it that can achieve this at both smaller and larger quantities. Additionally, the size of the product makes it so that shipping of the product, and hence offshoring, might prove difficult. Furthermore, due to the importance of CAS in industrial settings, the case company will likely face problems in terms of its image and how it can create enough trust with customers in order to compete with incumbent companies that have more experience.

1.4 Research questions

There is a lot of research in terms of the challenges and scaling of software companies face, e.g., the Lean startup methodology (LSM) proposed by Ries (2011) and the the Agile methodology proposed by Beck et al. (2001), but there appears to be less of a focus on the efficient scaling of manufacturing companies and the barriers they face. Additionally, most of the literature appears to focus more on the competitive strategy of companies and not its operations strategy or the link between the two. In a recent study conducted by Nirwan and Dhewanto (2015), the authors argue that there exists barriers to the implementation of LSM in B2B companies specifically concerning accessing customers early on since they may be large and hard to get.

As a result of the aforementioned problematization of current research and the current complexities the case company faces the following research questions are proposed:

RQ 1: *How does a startup's competitive strategy affect its operations strategy?*
RQ 2: *What is the impact of a startup's operations strategy on its business performance?*

In the proposed research questions above, competitive strategy consists of the strategic choices which refer to where and how the company competes, for example in which geographical market it competes and with what strategy. Specifically, competitive strategy is believed to impact operations strategy which in turn impacts business performance. Business performance refers to the startup's relative ability to achieve profitability, i.e., the impact is measured in terms of whether or not the decisions made in relationship to the startup's operations strategy increases the startup's profitability potential. Nevertheless, the aim of the thesis is not to determine to which extent the competitive and operations strategy affect the performance of a startup. Rather, it is to provide a fundamental understanding of how the competitive and operations strategy affect performance emphasizing determinants of performance. Thus, it is outside the scope of this thesis to empirically measure the performance outcome of those determinants.

1.5 Demarcations

In achieving the aim as mentioned above, it is also important to note that we make the following demarcations, i.e., areas that will not be touched upon or are outside the scope of the thesis:

- The thesis will not explore technical details that could affect the performance of the product, its manufacturability or possibility for differentiation since they require a more technical knowledge of the product.
- The thesis will not look into supplier specifics, e.g., supplier prices and differences between specific suppliers due to lack of time and resources to properly evaluate suppliers. Additionally, this is deemed to not provide any additional value to the research since the solution does not require any special contracts and can be manufactured mainly from standard components.
- The thesis will not cover how to communicate an offer to the market and customers. Since the main focus of the thesis lies with how to bring innovation to market and how to capture value, how to best align the company's properties to communicate the offered value to the market is out of scope.
- The thesis will not cover the impact of competitive strategy on business performance. The reasons for this are twofold. Firstly, the case company has already defined its competitive strategy in terms of where and how to compete which means that its competitive strategy will be treated as fixed. Secondly, because the case company is currently in the process of scaling up its production, the impact of operations strategy is of more interest.

1.6 Thesis outline

This thesis consists of six chapters; an introduction that introduces the reader to the subject, the case company and the industry it is active in as well as the research problems and questions that will be addressed. The following chapter, the literature review, will present relevant previous research and will be used in order to develop a conceptual model that was relevant in order to help answer the research questions. The method chapter will present the methodology used and a discussion about how different tools can be used to deal with potential problems such as confidentiality. This is followed by the analysis chapter where the conceptual model developed in the literature review will be applied to the case company. Chapter 5 consists of a discussion uses the analysis presented in chapter 4 in order to answer the research questions. Finally, chapter 6 *Conclusion* presents a recommendation to the case company based on the analysis and discussion and also points out limitations and future research opportunities.

2

Literature review

The following chapter will review existing literature in order to provide a foundation for subsequent analysis and discussion. The chapter consists of three sections where to first two covers competitive and operations strategy as well as the components of these two concepts in detail. The final section concludes by presenting a conceptual model that will later be used to analyze the case company. Moreover, the conceptual model describes the relationship of the constituting components and will act as a guideline in answering the purposed research questions.

It has been established that there exists a relationship between a company's competitive and manufacturing strategy and the impact on the company's performance (Ward and Duray, 2000) which in turn is based on the work of Skinner (1969) and shown in Figure 2.1. The figure shows, just as Skinner (1969) claimed, that a company's manufacturing and operations should be designed to fulfill the tasks demanded by strategic plans. Additionally, proper strategic positioning or aligning of operations capabilities can significantly impact competitive strength and business performance of an organization (Anderson et al., 1989).

However, as discussed in section section 1.3 *Research problem*, it is of interest to research how this relationship looks for a startup company. Since the first research question (*RQ1*) is closely related to the subject of competitive strategy while the second (*RQ2*) is related to the subject of operations strategy, this literature review will be structured in a similar way.

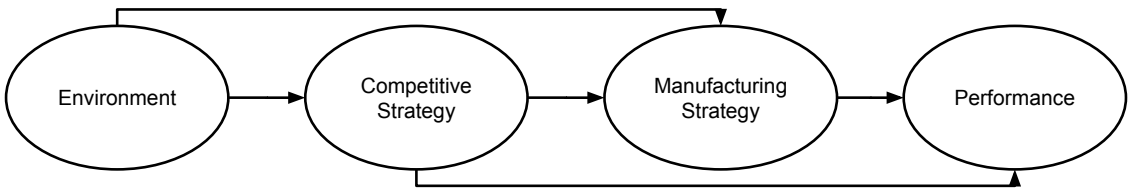


Figure 2.1: Conceptual model of manufacturing strategy in its context adopted from Ward and Duray (2000).

2.1 Competitive strategy

Throughout history, there have been countless interpretations of strategy and the meaning of it. Some of the earliest work is The Art of War by Sun Tzu composed between 475-221 BCE which places great emphasis on knowing yourself as well as the enemy (Britannica Academic, 2019). The actual word *Strategy* comes from the Greek word strategos which were an elected general in ancient Athens (Britannica Academic, 2019). Furthermore, the term *Strategy* has during a long time been a part of the military vocabulary and it is from the military several definitions of strategy stem. Table 2.1 shows some of the definitions of strategy over the years.

Table 2.1: Various definitions of strategy.

Reference	Definition
Von Clausewitz, 1940, p. 62	Strategy the use of engagements to attain the object of the war."
Hart, 1967, p. 335	"the art of distributing and applying military means to fulfil the ends of policy."
Grant, 2016, p. 15	Strategy is the means by which individuals or organizations achieve their objectives."
Porter, 1996, p. 68	Strategy is the creation of a unique and valuable position, involving a different set of activities."

Beyond the above-mentioned definitions of strategy, Mintzberg (1987) offers a contrasting view of what strategy is, suggesting that strategy can be viewed as five different perspectives (presented below), building upon earlier views and definitions. More importantly, Mintzberg (1987) do not claim that one definition of strategy is more valid than the other but rather claims that the five views are in some ways competing but also complementing. Thus, the conclusion that it is not enough to view strategy form only one perspective but to get the full picture it is important to see it from several aspects can be drawn.

- Strategy is a **plan**, a set of principles to guide an intended course of action.
- Strategy is a **ploy** building on the former remark of viewing strategy as a plan it can also be a ploy intended to outsmart or outmaneuver the current opponent.
- Strategy is a **pattern** within a set of actions and is therefore defined as *"consistency in behavior, whether or not intended"*.
- Strategy is a **position** and aims to position the organization in a specific position within an environment.
- Strategy is a **perspective** looking inwards within the organization in order to interpret the external environment.

As mentioned above, strategy involves an element of interacting with the environment wich in the company is located often referred to as Industry. To further explain the concept of industry Johnson et al., 2007, p. 59 offers the following definition: "*An industry is a group of firms producing the same principal product or service*". It is the interaction between the industry and the business in question which gives rise to the concept of strategic fit. The concept refers both to a fit between the external environment and the firm as well as the internal values, structures, systems, and goals Grant (2016). This concept also makes up a fundamental part of Porter's view of strategy as a position where it is supported by the activities undertaken by the firm. Further, it has been shown that firms that display a high degree of strategic fit correlate to a superior performance (Chorn, 1991).

Moreover, strategic decisions can be broken down into two broad questions as well as correlating areas of strategy (Grant, 2016, Beard and Dess, 1981), namely; a corporate strategy which aims to answer the question of where a business should compete and business strategy which aims to explain how the company should compete (Grant, 2016, Beard and Dess, 1981). As the primary focus of the thesis lies within the area of how a startup should compete by designing its operations strategy the area of business strategy will be important. However, based on the model by Ward and Duray (2000) presented in the introduction to this chapter, where to compete in terms of corporate strategy is still of importance, since it plays a crucial role in the profitability potential of a company. Both areas of strategy are explored in greater detail in the rest of this chapter.

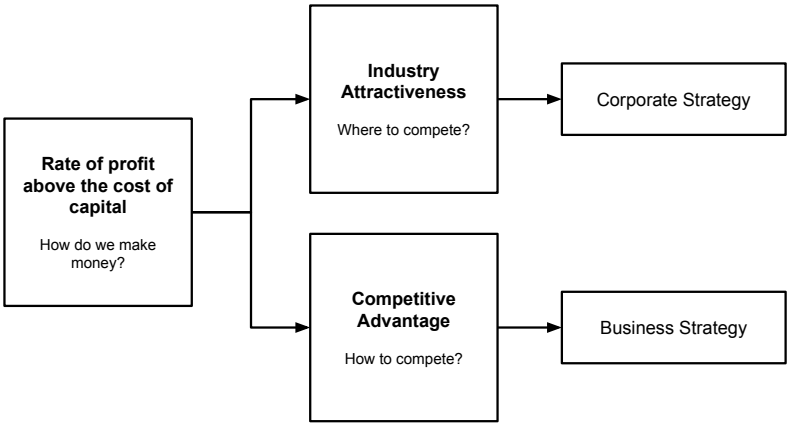


Figure 2.2: Adapted model of strategic dimensions from Grant (2016).

2.1.1 Corporate strategy

To better grasp the notion of corporate level strategy, Beard and Dess (1981) offers the following definition: *"corporate-level strategy is defined in terms of variation in the deployment of a firm's resources among the portfolios of industries within which all business firms compete."* Thus, the corporate strategy is concerns the geographical scope, product scope as well as the vertical of the firm.

As seen in Figure 2.2 corporate strategy has a clear link to the attractiveness of an industry (which can be defined as *"a group of firms producing the same principal product or service"* (Johnson et al., 2007, p. 59)). It is therefore a primary concern for any startup or business to assess if the current or future industry in which the startup or business are active within is attractive. Attractiveness here is referred to as the overarching profit potential within the industry, which could vary significantly (Grant, 2016). The attractiveness of an industry depends on several factors, for example the dynamics of the industry in terms of profitability potential as a function of competition (Grant, 2016) as well as the institutions within in the industry (Peng et al., 2009).

2.1.1.1 Industry dynamics

According to Grant (2016) strategy is fundamentally about achieving success, this quest for success leads to the question of what determines if a company is successful or not. Porter, 2008*b*, p. 81 describes the impact of industry structure on profitability accordingly:

> *"Industry structure drives competition and profitability, not whether an industry is emerging or mature, high tech or low tech, regulated or unregulated."*

Furthermore, Porter (2008*b*) defines five factors affecting the structure and therefore also the profitability of an industry, more commonly known as Porters five forces. If the forces within the industry are intense, they will put downward pressure on the profitability and subsequently lower it (Porter, 2008*b*). These five forces are:

- **Threat of New Entrants**: The first force that affects the profitability within an industry is the threat of entry by competitors. More importantly, it is the threat and not the actual entrance of a competitor that puts a lid on the profitability within the industry (Porter, 2008*b*). Hence, an industry that is currently profitable will attract attention from others who wants a piece of the pie.

- **Threat of Substitutes**: Substitution can occur both downstream and upstream (Porter, 2008*b*), corresponding to the supply-side and demand-side of a business. Substitution is defined by Porter, 2008*b*, p. 84 as a product that *"[...] performs the same or a similar function as an industry's product by a different means."* Thus, if there exist many alternatives to a supplied product within an industry, the profitability will suffer (Porter, 2008*b*) since it is easy to procure another solution.

- **Rivalry Among Competitors**: The rivalry between existing companies is the most direct source of competition greater rivalry will drive down profitability within the industry. The rivalry between firms is determined by two main factors; the intensity of which companies compete and the basis of competition. For example, if the companies are similar in size and number, it will increase the

intensity. Similarly, if products are undifferentiated and equal in performance, the rivalry among firms will increase (Porter, 2008*b*).

- **Bargaining Power of Suppliers**: Powerful suppliers can increase the pressure within the industry by increasing their share of profits relative to the total available profits in the industry. For example, suppliers that supply a differentiated good as well as being few in numbers can squeeze the margins of producers upstream and thus capturing more of the value (Porter, 2008*b*).

- **Bargaining Power of Buyers**: Powerful buyers, like suppliers, can exercise power on the producer and therefore squeeze the margins within the industry. Likewise, if there exist only a few buyers for a specific product, they have a significant influence on the profit left to producers which lower the attractiveness of the industry. Furthermore, the power of buyers is determined by two major factors; the price sensitivity of buyers and the leverage of buyers (Porter, 2008*b*).

Since first introduced in 1979 Porter's five forces have been widely adopted by the business community with over 60 000 citations. However, even though or as a cause of its widespread adoption, it has also been widely criticized. Firstly, the model has been criticized for lacking academic rigor stems from the choice of forces which according to O'Shaughnessy (1984) (as cited by Speed (1989)) are made arbitrary. Secondly, Grant (2016) states that the framework lacks empirical evidence since it seems that the industry dimension has little effect in determining the profitability of the company. Even though its criticism the framework provides important insights into guiding the strategic process. Further supported in a recent study by Tavitiyaman et al. (2011) which links the structural forces of the hotel industry with the strategy formation and subsequently the performance.

One way to provide a more structured and in-depth view of the industry dynamics, is to follow the framework presented by E. Dobbs (2014), which is based upon the five forces forth put by Porter (2008*b*). Furthermore, the framework stresses the analysis of the underlying factors of each of the five forces as presented by Porter (2008*b*), leading to a more grounded analysis as well as a better understanding of the industry.

2.1.1.2 Strategic alliances

Grant, 2016, p. 401 defines a strategic alliance as *"a collaborative arrangement between two or more firms to pursue agreed common goals."* Strategic alliances are a fast flexible way to access complementary skills and resources from other companies (Dyer et al., 2001). This arrangement can take many different forms e.g., it may or may not involve a transaction of equity, it may take the form of a joint venture or it may be a network of alliances (Grant, 2016). Strategic alliances have the potential to create value for the involved companies in several ways. It enables companies to share knowledge about logistics, technical development as well as R&D (Chan et al., 1997). Additionally, alliances can help firms enhance their market power

(Kogut, 1991), increase efficiencies (Ahuja, 2000), access new or critical resources or capabilities (Todeva and Knoke, 2005, Rothaermel and Boeker, 2008) and entering new markets (García-Canal et al., 2002).

The advantage of strategic alliances in being able to provide knowledge as presented by Chan et al. (1997) can be likened to the ability to access new capabilities presented by Rothaermel and Boeker (2008). Furthermore, strategic alliances ability to access complementary resources and skills that reside in other companies (Dyer et al., 2001) means that it can be seen as a way to bridge available and needed knowledge. This can be likened to the concept of partner complementarity presented by Kale and Singh (2009), i.e., the extend to which the alliance provides non-overlapping resources to the partnership.

Integrating businesses into a hierarchy reduces the transaction costs and increases the control of the value chain. Similarly, going to the market increases flexibility, apart from system-wide flexibility, but in turn, increases the transaction costs. In contrast to the two alternatives mentioned above, Powell (2003) introduces the concept of a network which offers a middle ground between a hierarchy and the market. Specifically, a network offers greater potential for knowledge transfer, less commitment than a hierarchy while maintaining a certain degree of flexibility. Networks are especially suited when the environment is uncertain, and resources are variable as well as offering an increased potential for enhancing the utilization of technological innovation (Powell, 2003). To achieve these networks strategic alliances provides pliable means.

Furthermore, in deciding to which degree of vertical integration or strategic alliances Grant (2016) provides a framework–shown in Figure 2.3–based on two variables principally the degree of formalization that is possible and the degree of involvement corresponding to the size of investment needed.

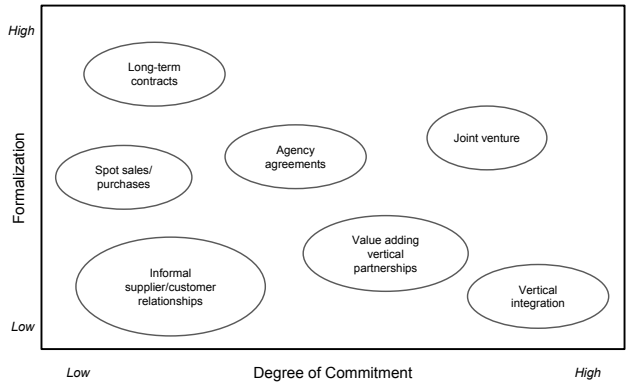


Figure 2.3: Adopted framework of different types of vertical integration based on Degree of commitment and Formalization (Grant, 2016).

Furthermore, Kale and Singh (2009) presents a set of key drivers for alliance success during the different phases of the alliance life-cycle. During the *Alliance Formation*

and Partner Selection phase, the key drivers for success are the partner's complementarity, compatibility and commitment. Partner complementarity refers to the extent to which a partner contributes non-overlapping resources to the partnership, while partner compatibility refers to the fit between the partners' culture and partner commitment refers to the willingness of the partner to make both short- and long-term commitments (Kale and Singh, 2009).

Supporting this, Dean and Yunus (2001) asserts that it is paramount for any company entering a strategic alliance to clearly outline its expectations, requirements, and expected outcome. The choice of a partner should also involve an analysis of the operations expertise and the cultural fit with the company (Dean and Yunus, 2001). Brouthers et al. (1995) specifically states that should only be utilized when the four Cs of the strategic alliance's are present. The four Cs include complementary skills, cooperative cultures exists between the firms, the firms have compatible goals, and equivalent levels of risk are involved (Brouthers et al., 1995).

2.1.1.3 Institutional factors

Peng et al. (2009) presents the institutional based view, a contrasting perspective to the two leading strategic management perspectives, the industry based view and the resources based view. The resource-based view looks inward in order to inform the strategy making and thus establish a potential competitive advantage while the industry based view looks outward, for example as in Porters five forces in order to determine the strategy of a firm. According to Peng et al., 2009, p. 64 institutions are defined as the *"[...] rules of the game."* Institutions can be divided into formal, e.g., rules, laws, and regulations and informal, e.g., norms, culture, and ethics (Peng et al., 2009). Institutions play a particularly important role within innovations as the value captured by the inventor of the innovation is to a large extent dependent on the ability to establish property rights (Grant, 2016).

Moreover, Peng et al. (2009) advocates the institutional based view of strategy to get a more complete picture of the competitive landscape and how it interacts between the other two views. For example, in order to asses the current climate of the case company it is not only important to look at the resources and capabilities and the direct competitors, as the industry based view advocates, but also predict and align the company with the rules of the game. Specifically, according to Bergman and Klefsjö (2010) there are now several companies that demand that their suppliers have documented quality management systems. One common quality management system is the ISO 9000 family which includes quality management, quality management systems, requirements, processes for continuous improvements, and guidelines regarding carrying out audits for quality and environmental issues (Bergman and Klefsjö, 2010).

2.1.2 Business strategy

Moving from corporate strategy of where to compete to business strategy of how to compete is according to Porter (1980) a central question. Business strategy is defined by Beard and Dess, 1981, p. 666 as *"[...] variation in firm characteristics relevant to competitive success or failure within a given industry"*. Hence, when the strategic choices about which industry to be in has been made the focus shifts towards aligning the business or firm characteristics with that of the industry.

2.1.2.1 Competitive advantage

Barney, 1991, p. 102 defines competitive advantage as *"implementing a value creating strategy not simultaneously being implemented by any current or potential competitors."* Hence, indicating the importance of uniqueness as well as pursuing a strategy which creates value for customers and users alike. Further exploring the idea and importance of creating unique and unparalleled value within a given market, Grant, 2016, p. 168 provides the following definition of a competitive advantage; "*When two or more firms compete within the same market, one firm possesses a competitive advantage over its rivals when it earns (or has the potential to earn) a persistently higher rate of profit."*

However, in order to withstand the creative destruction of innovation, it is suggested that a firm should strive for a sustainable competitive advantage (Grant, 2016). This sustainable competitive advantage is defined by Barney, 1991, p. 102 as *"implementing a value creating strategy not simultaneously being implemented by any current or potential competitor and when these other firms are unable to duplicate the benefits of this strategy."* This definition stresses the importance of gaining a competitive advantage that is hard or unattainable for any other firm hence providing a shield against attacks from competitors as well as industry changes.

Moreover, Barney (1991) presents a framework in evaluating firms resources potential to create a sustainable competitive advantage. The four attributes that the firm resource need in order to become a sustainable competitive advantage is presented below:

- **Value**: The resource must be valuable in the sense that it enables the firm either to create or implement strategies that improve effectiveness or efficiency. Further, it could also be that the resource enables the firm to exploit an opportunity or suppress a competitive threat in the environment.

- **Rarity**: The resources must be rare by definition if else it will not provide any base for a competitive advantage. If a large number of firms have the same opportunity to exploit a resource, it will not give any advantage to anyone.

- **Inimitability** :The resource must be imperfectly imitable in order to provide a basis for a sustainable competitive advantage since it is not enough for the recourse to be valuable and rare if competitors easily replicate it. The attribute

of imperfect inimitability is in turn dependent upon three factors; namely, (1) the unique history of conditions, (2) causal ambiguity, and (3) social complexity.

- **Non-substitutability**: Finally, the resource must be non-substitutable in terms that it cannot exist other equally valuable resources that are themselves either not rare or imitable. To be more specific, there cannot exist another set of valuable, rare, and inimitable resource that could be implemented by another firm since this would erode the sustainable competitive advantage.

Furthermore, in order to achieve a long run superior profitability a business must have a sustainable competitive advantage (Porter, 1980). If it is not sustainable there is a likelihood that the competitive advantage will erode quickly by the imitation of competitors. Porter (1980) argues that there exist only two archetypes of which a firm can achieve a competitive advantage; low-cost or differentiation, which in turn are reliant upon the industry structure. Combining these two archetypes with the scope of the firm provides a foundation of three generic strategies according to Porter (1980). Porter (1980) defines the three generic strategies, shown in Figure 2.4 below, as; overall cost leadership, differentiation, and focus. Cost leadership results in above-average returns because of the firm's low-cost position. Differentiation means creating an offering that is perceived industry-wide as being unique and therefore creates brand loyalty as the uniqueness are valued by customers. Focus is achieved by focusing on a few markets and better meeting customer needs in these.

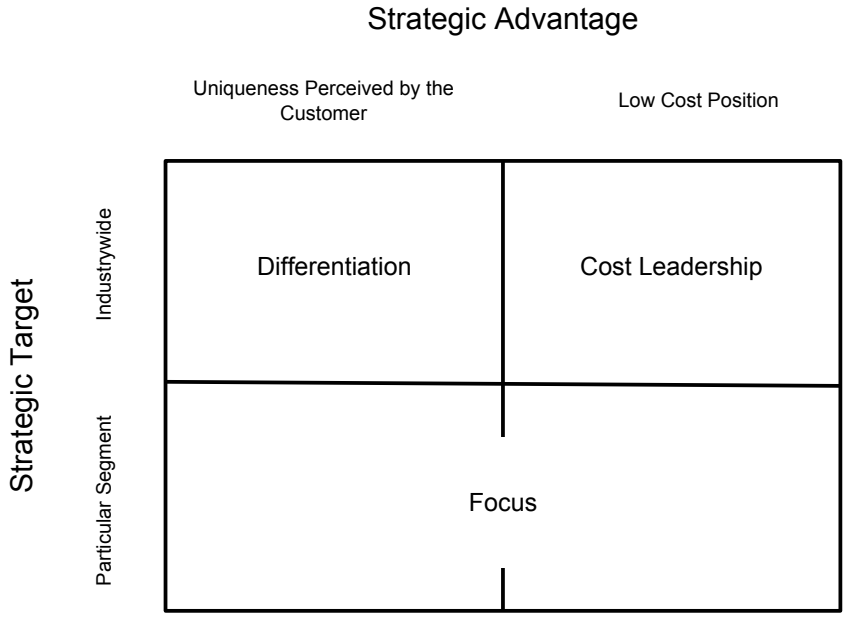
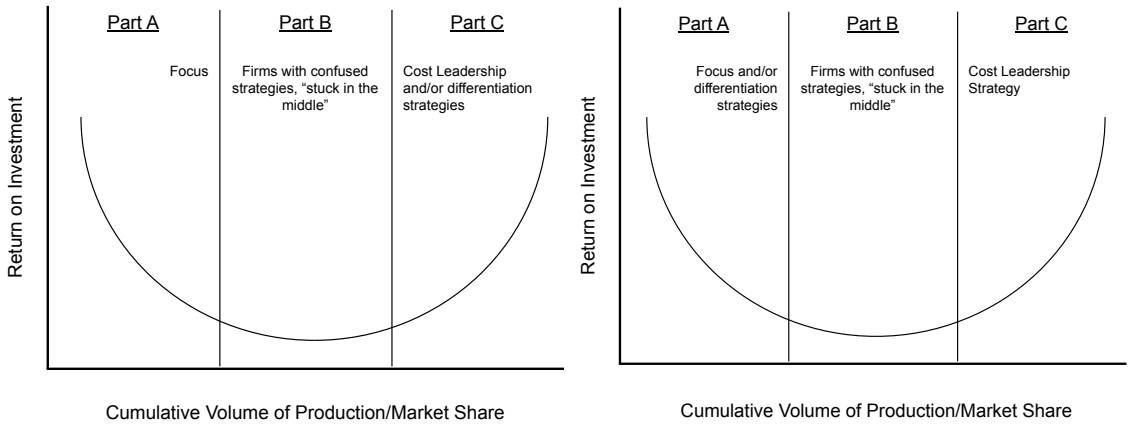


Figure 2.4: Porter's Generic Strategies (Porter, 2008*a*).

Moreover, Porter (1980) argues that the generic strategies mentioned above are not only separate but mutually exclusive, i.e., a company pursuing more than one generic strategy will end up with sub-par performance. This is a phenomenon Porter (1980) calls stuck in the middle and results in no competitive advantage for the company.

Wright (1987) postulates that the theories created by Porter can be further refined. In doing so Wright (1987) suggests that a better relationship between return on investment (ROI) and cumulative volume of production or market share and the generic strategies purposed by Porter (1980). The relationship proposed by Porter (1980) and Wright (1987) is presented in Figure 2.5. The refinement of the relationship lies within the notion that a company with a smaller market share or volume should pursue the Focus strategy in order to gain a high ROI. As well as the idea that a firm with a larger market share or volume could also have a Differentiation strategy. To support this observation Wright (1987) gives the example of IBM which has pursued a differentiation strategy for a long time. Furthermore, Wright (1987) concludes that if a large firm within an industry can choose which strategy to compete with they will likely choose the one that offers greatest profitability potential.



(a) Porter's original relationship. **(b)** The refined relationship.

Figure 2.5: A comparision of Porter's orginal relationship between ROI and Cumulative volume of production or market share and the refined relationship argued by Wright (1987).

2.1.2.2 Innovation strategy

As argued by Pisano (2015), the root cause of why companies fail to consequently create and capture the value of innovation is the lack of a pronounced innovation strategy. Therefore, business should apt to define a distinctive strategy of how firms' innovations will support their business strategy. Additionally, the innovation strategy should address how the innovation will create value as well as how the company will capture the value created by the innovation. Besides, Teece (1988) argues that it is not necessarily sufficient for an innovation to be technologically successful but the firm must also be able to capture the potential value provided by the innovation. Therefore, the focus will hereinafter be on how to capture value from an innovation.

According to Grant (2016) an innovation is diffused on both sides of the market, i.e., the demand and supply-sides. On the demand-side the innovation is diffused through the adoption of the product or service by users and customers and on the supply-side by imitation from competitors (Grant, 2016). Therefore, the blockage mechanisms

of imitation are critical for the startup in order to capture value from its innovation. This distribution of value offered by innovation is called the regime of appropriability, which can be both strong and week. A strong regime of appropriability offers greater value captured by the innovator vis-a-vis a weak regime of appropriability were other parties would capture more of the value Grant (2016).

The regime of appropriability is made up of four conceptual parts; property rights of the innovation, tacitness and complexity of the innovation, lead time, and complementary resources Grant (2016). This is further supported and extended by Hurmelinna-Laukkanen and Puumalainen (2007) who adds the mechanisms of human resource management, practical technical means, and institutional protection. In contrast to the positive influence of a strong appropriability regime as suggested by several scholars (Grant, 2016, Hurmelinna-Laukkanen and Puumalainen, 2007, Cohen et al., 2000) Hurmelinna et al. (2007) argues that the appropriability regime has two sides to it. That is, having a weaker appropriability regime is not necessarily disadvantageous as they argue that positive effects as network externalities and knowledge transfer requires this. Hence, Hurmelinna et al. (2007) conclude that it is how the company handle the appropriability regime that will yield a potential competitive advantage, therefore creating a greater chance for capturing value.

The effectiveness of each factor of the appropriability regime differs from industry to industry (Cohen et al., 2000); therefore, it is necessary for any startup to adopt the strategy of how to capture value from the innovation to the specific characteristics of the industry. As seen in section A.3 the effectiveness of patents in the industry of general and special machinery is one of the few industries where it is estimated to be effective by more than 45% of the respondents. However, lead time is determined to be the best mechanism to protect the companies innovation as stated by over 52% of the respondents, which is also supported by López and Roberts (2002) and Hurmelinna et al. (2007) as one of the most significant mechanisms in protecting the innovation from imitation.

2.1.3 Key success factors

Key success factors are defined by Grant, 2016, p. 82 as "*[...] those factors within an industry that influence a firm's ability to outperform rivals*". Grant (2016) proceeds in determining the origin of key success factors as the outcome of analyzing the customers as well as analyzing the competition. Which then forms a basis of how to succeed within that given industry. For example, the steel industry is based upon low prices, product consistency, and reliability of supply on the customer side. On the competitive side, the steel industry is characterized by intense price competition stemming from undifferentiated products, excess capacity, exit barriers, and high fixed cost (Grant, 2016).

Taking a more holistic view of the nature of key success factors Grunert and Ellegaard, 1992, p. 17 defines a key success factor as "*[...] a skill or resource that a business can invest in, which, on the market the business is operating on, explains a major part*

of the observable differences in perceived value and/or relative costs." Furthermore, key success factors are related with the competitive advantage of the business in the sense that in order to achieve a competitive advantage, a company first needs to do well on its key success factors. It is the competitive advantage that enables companies to; (1) provide greater value for the customer and users of the product or service and (2) creating or enabling the business to earn persistently higher profits than that of their competitors.

2.2 Operations strategy

Operations is one of the three core functions of any organizations in addition to the marketing and the product and service development functions and is responsible for managing the resources that create and deliver services and products (Slack et al., 2007). There are several definitions of operations strategy and the concept is sometimes used interchangeably with manufacturing strategy (Anderson et al., 1989). Table 2.2 below shows a selected set of definitions.

Table 2.2: Various definitions of operations strategy.

Reference	**Definition**
Slack et al., 2007, p. 70	"Operations strategy concerns the pattern of strategic decisions and actions which set the role, objectives and activities of the operation"
Wheelwright, 1984, p. 85	[...] a manufacturing strategy consists of a sequence of decisions that will enable a business unit to achieve its desired competitive advantage"
Anderson et al., 1989, p. 137	"[...] a long-range plan or vision for the operation function. This plan must be integrated with the business strategy and implemented throughout operations."

Slack et al. (2007) presents a set of design activities within operations management, consisting of five components; Supply network design, Layout and flow, Product/service design, Process technology and People, jobs and organization Out of the five components, this literature review will only cover the three that are deemed to be within the scope of this thesis. This means that the areas of Process technology, i.e. what type of technology will be used in the operations, and People, jobs and organization will not be covered.

There is a link between operations strategy and firm performance (Ward and Duray, 2000). An effective operation is not necessary the most efficient one but rather the one that best fits the needs of the business (Wheelwright, 1984). Slack et al. (2007) presents four different perspectives on operations strategy as viewed by different authors. These are;

- **The top-down perspective** which sees operations strategy in a hierarchy of strategies and subservient to the decisions of corporate strategy. Each business unit will put together its own business strategy with different objectives which will probably result in different operations strategies. Thus, the role of operations is largely to implement business strategy.

- **The bottom-up perspective** which sees strategy as being shaped by operational level experiences. The constraints and capabilities of individual functions will be taken into account when review the corporate strategy. Strategic ideas emerge over time which makes the ability to learn from experience and continual and incremental improvement especially important.

- **The market requirements perspective** which sees operations strategy as defined by its ability to satisfy customer needs. An operation will choose which performance objectives to focus on based on what the customer values. This perspective also takes into account the fact that various needs are valued differently and that this can change over a product's life-cycle.

- **The operations resource perspective** which is based on the resource-based view of the firm and views strategic success as a function of the way an organization inherits, acquires or develops its operations resources. This perspective may identify both constraints to satisfy some markets but also capabilities which can be exploited in others.

Analogous to the top-down and bottom-up perspectives, Hayes and Wheelwright (1984) mean that operations can contribute to an organization's objectives in four stages; from internally neutral where the operations function is holding the organization back to externally supportive where the operations function is providing the foundation for competitive success.

2.2.1 Performance objectives

Wheelwright (1984) defines a set of driving forces that establish the context in which the competitive advantage is defined and pursued; the firm's dominant orientation, its diversification pattern and its perspective on growth. A firm's dominant orientation refers to what guides its decision making, i.e., whether it is market oriented, material or product oriented, or technology oriented, diversification patterns refers to the degree of diversification a company pursues and perspective on growth refers to the company's attitude towards growth–whether it sees it as an input to its planning process or as an output.

These driving forces have an impact on the company's manufacturing strategies, with a broader diversification pattern leading to more variety in the business strategies pursued and thus in the corresponding manufacturing strategies. Additionally, in high-growth businesses, getting the product out tends to take precedence over establishing a competitive advantage on other dimensions of manufacturing capability. These driving forces can be summarized in the company's choice of competitive

priorities (Wheelwright, 1984), i.e., which performance objectives a company chooses to focus on. There are generally five performance objectives that apply to any operation (Slack et al., 2007), namely;

- **Quality**: Refers to doing things right by not making mistakes and providing the customers with error-free goods and services. High quality has the external advantage of increasing dependability towards customers and the internal advantage of reducing costs by reducing mistakes.

- **Speed**: Refers to doing things fast, thereby minimizing the time it takes for the customer to receive the goods or services and increasing the availability of it. Fast speed has the external advantage of reducing the time customers have to wait for delivery of goods and services and the internal advantages of reducing both inventory and risks since production can be done later.

- **Dependability**: Refers to doing things on time in order to keep delivery promises. High dependability has the external advantage of reducing negative customer experiences and the internal advantages of saving time and money and providing stability by avoiding problems.

- **Flexibility**: Refers to the ability to change and being able to adapt the operation to unexpected circumstances. High flexibility has the external advantage of the operation being able to provide more options to customers and the internal advantages of being able to respond to unexpected events faster as well as saving time and maintaining dependability by not wasting time waiting and disrupting operations.

- **Cost**: Refers to doing things cheaply, thereby producing goods and services that can be priced appropriately for the market. Low costs has the external advantage of allowing the company to offer a lower price to customers and the internal advantage of increasing total productivity by reducing the inputs to the operation.

Furthermore, Bergman and Klefsjö (2010) present several dimensions of quality for products, e.g., reliability–how often problems occur and how serious they are, performance in terms of significance to the customer, safety–that the product does not cause personal injury or damage and durability–that the product can be used, stored and transported without deteriorating or being damaged.

Which objectives a company chooses to focus on depends on the requirements of the customers as well as its own needs. Performing well on each of these objectives has several advantages, both internally and externally. However, there are also trade-offs between the performance objectives (Slack et al., 2007). However, which performance objectives are important varies over a product's life-cycle. Initially as the product is being introduced and before a significant sales volume is achieved, quality and flexibility are likely to be dominant since maintaining performance and responding to changing customer requirements is needed. As the market grows and more competitors enter the market, speed and dependability becomes increasingly

dominant and as the market matures costs takes an increasingly dominant role (Slack et al., 2007).

It is possible to build operations strategies around the different performance objectives. In their literature review of articles on the subject of operations strategy in the period of 1980-2006, Luz et al. (2008) identified three generic operations strategies centered around these performance objectives; strategies aimed at reducing costs, strategies focusing on the highest quality products, and strategies of companies that implant new technologies and new operations processes.

2.2.2 Supply network design

All operations consists of a set of processes connected to each other to form a network. A supply network is this network of operations and describes the whole industry, including the operation's suppliers and customers (Slack et al., 2007). Slack et al. (2007) defines three decisions in designing a supply network, namely;

1. **The do-or-buy decision:** How the network should be configured, i.e., determining its overall pattern. For example, the number of direct suppliers in the network or the degree of vertical integration.

2. **The location decision:** Where each part of the network should be located. The location decision has to balance the variable costs, the service the operation is able to provide and the revenue potential for each potential geographical location.

3. **The long-term capacity management decision:** What physical capacity each part of the network should have. The long-term capacity management decision need to consider how to balance capacity in order to avoid having the network's capacity limited to the capacity of the slowest link, and when to increase capacity.

Before deciding how to structure its operations, an organization first needs to make an organizational decision as to whether perform the operation in-house or whether to outsource it (Graf and Mudambi, 2005). That is, the do-or-buy decision comes before the location decision. This is in line with the order of the three decisions presented by Slack et al. (2007).

However, Mudambi and Venzin (2010) asserts that offshoring and outsourcing decisions are not static but change over time and identified two main reasons for adapting offshoring and outsourcing decisions; firm level and external dynamics. Firm level dynamics include spillovers and catch-up where firms from emerging countries have incentives to develop competencies that allows them to control higher value creating components. Environmental dynamics focuses on the competitive environment and how the comparative advantages of nations varies over time.

Contractor et al. (2011) describes several of both the pull and push factors that are

driving high-value operations to be outsourced or offshored. Pull and push factors can be likened to demand- and supply-side-influences as presented by Slack et al. (2007). Demand-side factors are those which influence customer service and revenue, such as labor skills, image and convenience for customers, while supply-side factors are those which influence cost at a location, such as labor costs, land costs and transportation costs (Slack et al., 2007). The pull and push factors include reducing wages and costs, escalating R&D costs and risks, internal creativity limitations, demand for foreign scientific talent, knowledge clusters in emerging countries, and the growing importance of foreign markets (Contractor et al., 2011). Furthermore, Abele et al. (2008) found that there are four forces accelerating global production; factor cost differences–primarily in labor costs, high growth in emerging markets, lower transaction costs and fewer trade barriers.

The choice of how to configure a supply network depends on the degree of operational and structural risk. Operational and structural risk in turn depends on the organization's ability to codify and monitor the work, respectively, combined with the precision of metrics used to measure process quality. Higher risks mean that organization's will want to keep its operations close, both geographically and organizationally (Aron and Singh, 2005).

2.2.2.1 The do-or-buy decision

Outsourcing refers to value added by contractual external providers, both nationally or abroad (Contractor et al., 2011) and can generally result in lower costs due to economies of scale for the outsourced company but has the disadvantage of making communication more difficult and negatively impacting quality, speed, dependability, and flexibility. Additionally, Dvořáček (2010) identified three types of costs related to outsourcing, namely; production costs in a functional area–the costs charged by the provider, transaction costs–the cost of crafting, checking and enforcing the contract, and hidden costs–costs related to e.g., managing the transition of the implementation. However, although performing the activity in-house brings it under the company's control, it also requires additional knowledge and resources (Slack et al., 2007). Slack et al. (2007) presents a decision logic for the do-or-buy decision, seen in Figure 2.6, as well as a set of advantages and disadvantages in terms of the previously mentioned performance objectives.

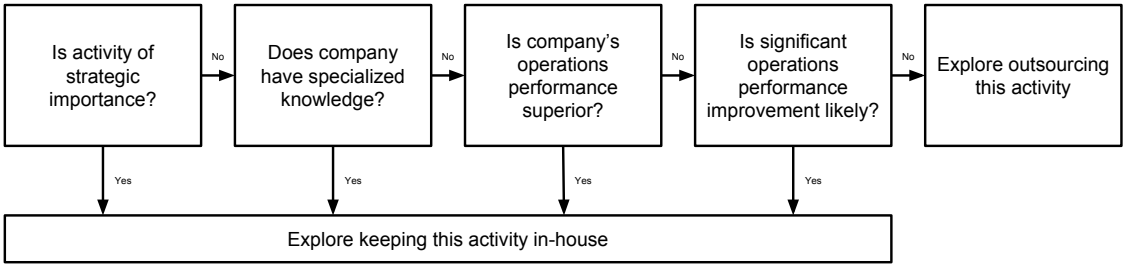


Figure 2.6: The decision logic for the do-or-buy decision, adopted from Slack et al. (2007).

If the organization chooses to keep the activity in-house, it will also have to make a decision as to the degree of vertical integration it will want to achieve. Vertical integration refers to the extent to which an organization owns the network of which it is part (Slack et al., 2007). The concept of vertical integration is closely tied to the concept of transaction cost economics (TCE) developed by Williamson (1979). There are three attributes that give rise to transaction complexity; asset specificity, uncertainty, and frequency, and that drive managers towards hierarchy (Williamson, 1985), that is, integrating the activity within the organization rather than buying it on the market.

Vertical integration has both advantages and disadvantages. The advantages of extending the boundary of the firm include the access to authority, the organization's ability to shape social identity and the shaping of the flow of knowledge (Zenger et al., 2011). The increase of control can therefore lead to improved quality and dependability. Additionally, vertical integration reduces transaction costs (Williamson, 1975) and allows for better protection of trade secrets (Novak and Stern, 2008). In terms of disadvantages, moving towards hierarchy means that the organization misses out on the advantages of markets such as high-powered incentives, information aggregation and matching and sorting (Zenger et al., 2011).

Further exploring the trade-off as pointed out by Williamson (1975) that transaction costs are inherently lower within a hierarchy than in a market implies that transaction costs increase with the number of suppliers. This notion is further supported by Bakos and Brynjolfsson (1993) who note that there is an optimal number of supplier based on Fit and Coordination costs. However, Porter (2008*b*) argues that an increased number of suppliers will lower the dependency and, therefore, create a more favorable position for the organization. This is not true according to Bakos and Brynjolfsson (1993) as there exists an inverted U relationship between the benefit for a buyer and the buyer bargaining power.

Additionally, the scope of suppliers also depends on the nature of the investment. If the investment can easily be transferred as well as having a low complexity in terms of contract specifications the optimal number of suppliers can be determined by economic and technical factors (Bakos and Brynjolfsson, 1993). Vice versa is true if the investment is relationship-specific and highly complex in terms of contract specifications (Bakos and Brynjolfsson, 1993). In summary, for every investment situation there exists a different number of optimal suppliers.

Table 2.3: Influence of contractability and specificity on the number of suppliers as summarized by Bakos and Brynjolfsson (1993).

Investment characteristics	**Contractible**	**Non-contractible**
Specific	Many	Few
Non-specific	Many	Many

2.2.2.2 The location decision

Offshoring refers to the geographical relocation of activities abroad (Contractor et al., 2011) and brings both advantages and disadvantages. Dunning (1980) presents three determinants of international production; ownership advantages, location advantages and internalization advantages. Ownership advantages refer to the advantages that come from controlling an activity, location advantages refer to advantages specific to the location where production is located and include lower labor and material costs, and internalization advantages refer to the advantages of bringing the relationship within the firm, thus reducing transaction costs (Dunning, 1980).

Locating an operation in a country where wages are low will lower labor costs but can increase the required number of repairs if worker skills are low (Bock, 2008), thus resulting in worse quality. Additionally, Abele et al. (2008) presents a set of location parameters, e.g., labor costs, cost of materials, labor and capital productivity and other quantitative factors such as distance from relevant markets and transportation costs.

When it comes to the sourcing of parts, a production network's sourcing strategy needs to consider what to source locally and what not to (Abele et al., 2008). Sourcing strategies can be classified into the following four segments;

- **Strategic partnerships**: Parts should primarily be purchased from established suppliers and only be sourced locally if technical and quality risks or the possibility of loss of know-how is low and local suppliers have proved trustworthy. Strategic partnerships usually includes technically complex components that relate to the company's intellectual property.

- **Global sourcing**: Local sourcing is closely coordinated with the central purchasing department in order to achieve efficiency which means that parts are purchased from whichever supplier has the most favorable offer. Global sourcing usually includes high-volume standard components with low logistics costs.

- **Local quick wins**: If parts have high logistics costs compared to their value and short lead times they are candidates for local sourcing. Local quick wins usually includes simple components.

- **Local supplier development**: If local sourcing is attractive but local suppliers do not have the necessary skills, local suppliers can be developed, for example by convincing existing suppliers to relocate. Local suppliers development usually includes more complex components that could still be sourced locally.

In terms of global sourcing, Slack et al. (2007) bring up several factors that need to be taken into consideration, namely purchase price, transportation costs, inventory carrying costs, cross-border taxes, tariffs, and duty costs, supply performance, and supply and operations risks.

Although there are many factors driving companies to offshoring, many organizations fail to generate the financial benefits they expected. Companies generally commit at least one of three mistakes when offshoring; they fail evaluate which processes to offshore and which they should not but rather focus on where to offshore, they fail to take into account all the risks that accompany offshoring and they do not realize that outsourcing is no longer an all-or-nothing choice (Aron and Singh, 2005).

2.2.3 Process design

Within operations, a process refers to the transformation of resources into an output of products or services, called an input-transformation-output process. Inputs can be materials, information, customers or transforming resources such as facilities and staff while outputs can be either pure products or services or a combination of both (Slack et al., 2007).

Slack et al., 2007, p. 96 defines process design as

> *"[...] the process by which some functional requirement of people is satisfied through the shaping or configuration of the resources and/or activities that comprise a product, or a service, or the transformation process that produces them."*

Slack et al. (2007) define four different process characteristics, known as the four V's, which determine how operations processes differ when transforming inputs into outputs. These four process characteristics are:

- The **volume** of an operation process' output. Higher volumes means that tasks are repeated often which makes it worthwhile investing in specialized equipment to bring costs down.
- The **variety** of an operation process' output. High variety means more options to the customer but generally results in higher costs since it becomes more difficult to automate and standardize the tasks.
- The **variation in demand**. High variation in demand means that the operation's resource utilization and thus unit costs will vary.
- The degree of **visibility** customers have of the creation of the output. The higher the visibility, the higher the demands on the customer skills of the operations staff.

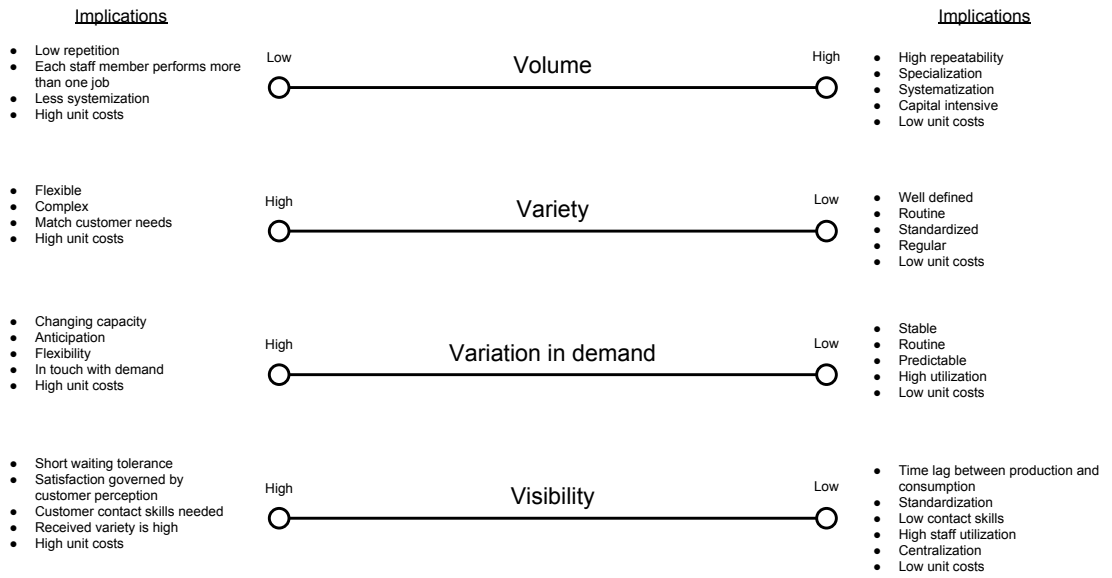


Figure 2.7: Implications of process characteristics, adopted from Slack et al. (2007).

Figure 2.7 shows the implications of an operation having high or low levels for each of these process characteristics. As can be seen from the figure, high volume and low variety, variation in demand and visibility generally tends to result in lower unit costs while the opposite generally results in higher unit costs.

The scaling of manufacturing brings both challenges, e.g., in terms of keeping up with demand, ensuring quality and increasing capacity (Slack et al., 2007), and opportunities in the form of economies of scale and learning effects (Grant, 2016). Both of these concepts describe how unit costs decreases as volume grows (Slack et al., 2007) or experience accumulates (Henderson, 1968). Since the volume and variety of the product(s) produced has an impact on the production process and production layout (Slack et al., 2007), what is suitable for a smaller company might not be best when the company is growing. Consequently, how a product scores on each of these characteristics has certain implications for the operation, with high volume, low variety, variation and visibility resulting in lower unit costs (Slack et al., 2007).

The process of transforming inputs into outputs can take many forms. Slack et al. (2007) present five process types and their position on the volume-variety continuum. These five process types are:

- **Project processes**: Deals with discrete, usually highly customizable products and has resources more or less exclusively devoted to it. Volume is low and variety is high so activities might be poorly defined and uncertain. Examples include software design, movie production and construction.

- **Jobbing processes**: Deals with complex, albeit physically smaller products than in a project process. Many jobs will only be performed once and never

repeated again. Another difference with project processes is that the products typically have to share resources with other products. Examples include made-to-measure tailors and many precision engineers.

- **Batch processes**: Produces more than one item at a time and has a lower degree of variety than jobbing processes. Depending on the batch size, batch processes can be similar to jobbing processes. However, if batches are large, batch processes can be relatively repetitive. Examples include machine tool manufacturing and the manufacture of components used in mass-produced assemblies.

- **Mass processes**: Produces items in high volume and low variety, usually through repetitive and largely predictive activities. Examples include automobile plants and television factories.

- **Continuous processes**: Produces higher volumes and lower variety than mass processes and usually operates for long periods of time. Examples include water processing, steel making and petrochemical refineries.

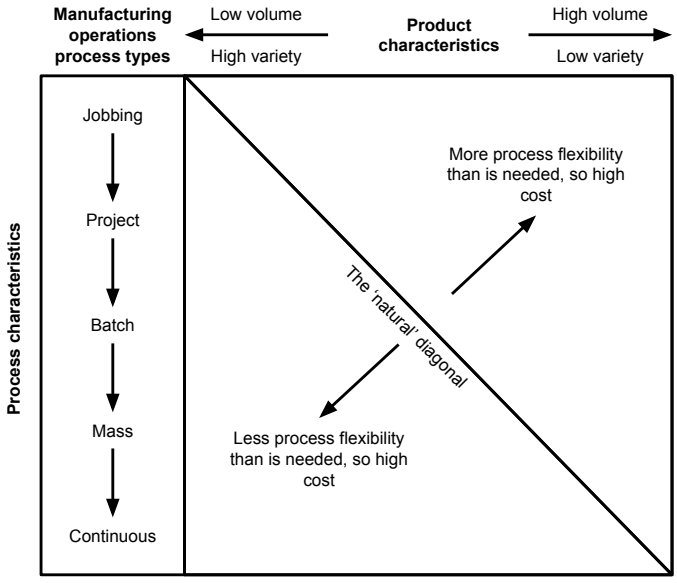


Figure 2.8: Product-process matrix, adopted from Slack et al. (2007).

Hayes and Wheelwright (1979*b*) developed the product-process matrix, seen in Figure 2.8, which shows how the product characteristics in terms of volume and variety are related to the process structure. The matrix contains a diagonal on which products are matched with their *natural* processes. When companies move away from this diagonal they become increasingly dissimilar from competitors and might become more vulnerable to attack. Hayes and Wheelwright (1979*b*) further argue that just as products and markets pass through a set of stages, so does the production process. At first, the production process is likely to be highly flexible but as it scales it becomes increasingly cost effective and standardized.

As a company grows, it will move down the diagonal and will have to face the choice of whether to lean above or below the diagonal. Maintaining a position above the diagonal will maintain flexibility but at the expense of increased costs while a position below the diagonal can make the company less flexible. However, as long as there is no major change in design or volume, leaning to a position below the diagonal can result in a significant competitive advantage (Hayes and Wheelwright, 1979*a*).

2.2.4 Layouts and flow

In addition to the type of process, another decision related to a company's operations strategy is what layout to use. The layout *"[...]means how transforming resources are positioned relative to each other and how various tasks are allocated to these transforming resources"* (Slack et al., 2007, p. 193).

According to Slack et al. (2007), there are four basic layout types, namely:

- **Fixed-position layout**: The product is stationary and materials, equipment and personnel are move as necessary.
- **Functional layout**: Similar resources and processes are located together.
- **Cell layout**: The transformed resources are pre-selected and are moved and located to the same part or cell.
- **Product layout**: Transforming resources are located in order to be convenient for the transformed resources.

Figure 2.9 shows how the different layouts are related to the different types of processes. As can be seen from the figure, certain layouts are more suitable with certain process types than others. For example, as both cell layouts and mass processes are suitable for products produced in high volumes with low variety, these are generally a better combination than a product layout and a project process.

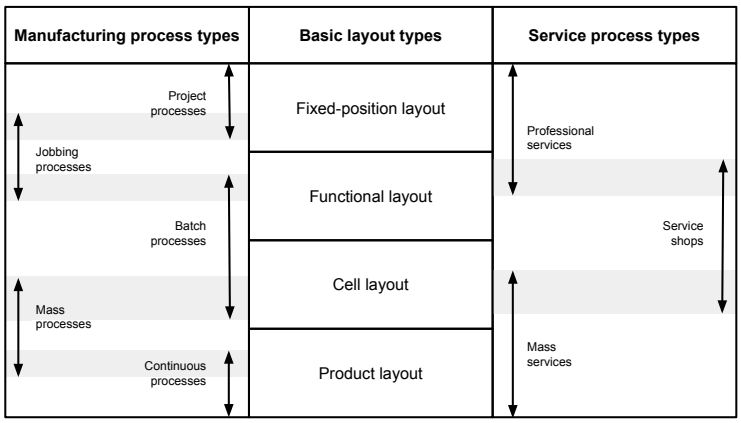


Figure 2.9: The relationship between process types and layouts, adopted from Slack et al. (2007).

2.3 Conceptual model

A conceptual model is a visual representation of the data in a system. Conceptual models serve two purposes, namely to present information in a simple, easily understood way and to aid readers in understanding of data Ruth (2019). The following will present a conceptual model that will be used throughout this thesis to help answer the research questions.

2.3.1 Composition of the conceptual model

Based on reviewed literature the theory of competitive strategy and operations strategy is combined into the conceptual model seen in Figure 2.10. The model builds primarily upon earlier work by Ward and Duray (2000) as presented in the opening of this chapter.

The conceptual model, shown in Figure 2.10, consists of three main components, namely Competitive strategy, Operations strategy and Business performance. Since the research questions presented earlier in this chapter aims to answer how competitive strategy affects operations strategy and what the impact of operations strategy is on business performance, the components of Competitive strategy and Operations strategy needed to be more specifically defined and therefore contains components as these concepts have been defined by Grant (2016) and Slack et al. (2007).

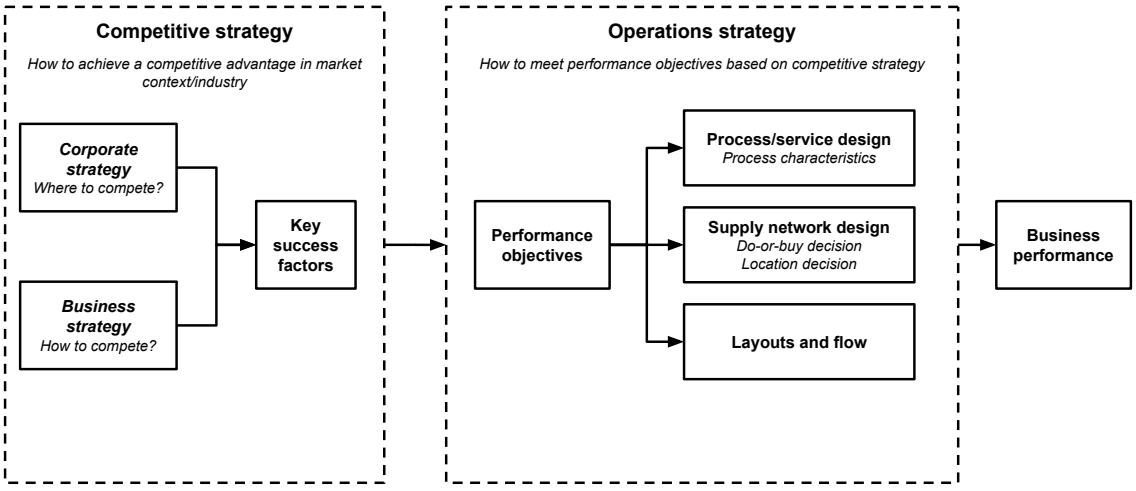


Figure 2.10: Conceptual model based on literature review.

The model presented in Figure 2.10 differs from previous work by Ward and Duray (2000) presented in the introduction to this chapter in four main ways. Firstly, the concept of competitive strategy has been defined as to contain the component of both Corporate strategy and Business strategy. Secondly, the model uses operations strategy instead of manufacturing strategy in order to cover the larger set of choices a firm makes about how and where to produce. Thirdly, performance has been more precisely defined as to encompass the more specific concept of business performance.

Finally, the impact of competitive strategy on business performance has been omitted due to it being out of scope for this thesis as described in section 1.5 *Demarcations*.

2.3.1.1 Relationship between competitive strategy and operations strategy

In terms of competitive strategy, this consists of two main parts: Industry attractiveness and Competitive advantage (Grant, 2016). These factors constitute the competitive strategy that is then the input into operations strategy. Moreover, the decisions about the company's competitive strategy may influence the number of available operations strategy options as well as investment possibilities.

The third component of competitive strategy presented in the conceptual model is *Key success factors*. In line with the definition used by Grunert and Ellegaard (1992), the concept of key success factors includes specific market characteristics, i.e., key success factors are industry and market specific and do not transcend markets. Additionally, the key success factors are, as the definition suggests, related to the perceived value of the customer and therefore also a guide of how to achieve competitive advantage within that market (Grunert and Ellegaard, 1992). Consequently, it is a necessary component of the conceptual model since it provides guidance as of where to invest in order to achieve a competitive advantage and outperform rivals.

That there exists a link between competitive strategy and operations strategy has been established (Skinner, 1969, Ward and Duray, 2000, Wheelwright, 1984). However, the different components of competitive strategy as defined by Grant (2016) impacts a company's operations strategy in different ways. A highly competitive industry where suppliers and buyers possess a high degree of bargaining power, an imminent threat of new entrants, and multiple substitutes with low switching cost will likely reduce the profitability within the industry, driving companies to at least partly adopting a low-cost strategy. A key success factor in such an industry is therefore likely to be a low price.

Firms failing to adjust to the institutional forces present both domestically and locally will likely suffer from inferior performance (Peng et al., 2009). For example, the government can set strict rules of the game which if the company does not align with will suffer from imposing lower performance (Peng et al., 2009).

Strategic alliances have the potential to create value for all parties involved (Chan et al., 1997), e.g., by allowing a startup to access knowledge that is important but not contained within the company. Strategic alliances could also allow companies to access new channels of distribution and manufacturing.

In terms of the impact of the type of competitive advantage a company chooses to pursue on its operations strategy, a differentiation strategy will have certain implications on what customers value. This means that the performance objectives of interest to the company are likely to be quality and dependability. In terms of the company's operations strategy, this means that both the do-or-buy and the location

decision will weigh towards alternatives with more control, i.e., in-house and on-shoring. Conversely, a low-cost strategy means that costs will be the most important performance objective. This means that control is not necessarily as important which removes the limitations in outsourcing and offshoring one's operations and opens up for the utilization of push or supply-side side factors in order to achieve the performance objective of low costs.

The regime of appropriability has several important implications for the operations strategy. Firstly, whether or not the startup possesses a patent to protect their innovation will likely impact the decision of whether or not to outsource the production of the innovation. This is due to the inherent risk of making information available for another company as supported by the high effectiveness of secrecy in protecting innovation seen in Appendix A.1. Secondly, the lead time which the innovation offers to the innovator limits the time, by definition, to move down the learning curve. Thirdly, the degree of complementary resources needed to capture the value of the innovation is likely to affect the operations strategy.

2.3.1.2 Relationship between operations strategy and business performance

Vickery (1981) presents a process model of manufacturing strategy, shown in Figure 2.11. As can be seen in the figure, the first step of the manufacturing strategy includes Identification and Weighting of Manufacturing Competitive Priorities, akin to the key performance objectives presented by Slack et al. (2007). The second step presented by Vickery (1981), Strategic Manufacturing Decision Making include process technology, vertical integration and manufacturing planning and can be likened to the supply network design decisions presented by Slack et al. (2007). Finally, Implementation and Manufacturing Performance Measurement focuses, as the names imply, on the implementation of decisions made previously and on the measurement of performance. However, as stated in section 1.5 *Demarcations*, both of these areas of deemed to be out of scope for this thesis and will therefore not be covered.

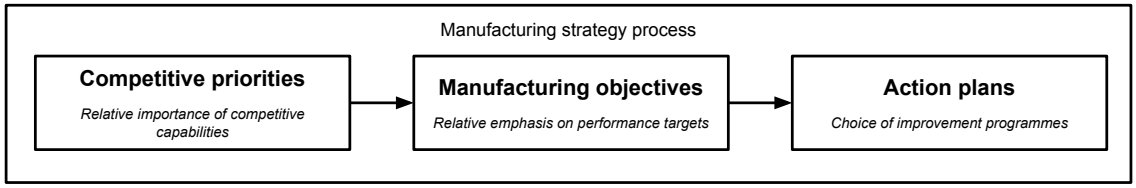


Figure 2.11: Manufacturing strategy process, adopted from Vickery (1981).

The models presented by Slack et al. (2007) and Vickery (1981) results in the *Operations Strategy* component of the conceptual model in Figure 2.10. As can be seen in Figure 2.10, the component of *Business Strategy* presented by Vickery (1981) has been expanded to cover the entire concept of Competitive strategy as presented by Grant (2016).

Furthermore, although several authors present a sequential order to the decisions related to a company's supply network design (e.g., Slack et al. (2007), Graf and Mudambi (2005)), the specific components of operations strategy following performance objectives are not arranged in a sequential order in the conceptual model since there are dependencies in multiple directions. For example, process characteristics such as volume and variety will have an impact on the supply network design decision.

Finally, the model takes the perspective, as presented by several authors, (e.g., Skinner (1969), Ward and Duray (2000), Vickery (1981)), that operations strategy fulfills competitive strategy and has an impact on performance, i.e., operations strategy is internally supportive as defined by Hayes and Wheelwright (1984) which is also in line with the top-down perspective presented by Slack et al. (2007). More specifically, the conceptual model treats a company's corporate strategy and its competitive advantage as fixed and therefore as an input that drives the operations strategy.

The impact of operations strategy's on business performance has been documented by several authors, (e.g., Slack et al. (2007), Ward and Duray (2000), Wheelwright (1984), Skinner (1969)). However, the different components of operations strategy as presented in Figure 2.10 impacts different aspects of business performance.

The design of a company's supply network is influenced by demand-side (pull) and supply-side (push) factors as presented by Contractor et al. (2011) and Slack et al. (2007). As presented by Slack et al. (2007), demand-side generally influences business performance by increasing revenues while supply-side factors generally influence costs.

The decisions a company in terms of process and service design will also influence a company's business performance. By having a process design that is adapted to high volume and low variety products, a company can decrease its unit costs because of economies of scale and specialization while a more flexible design can result in higher quality and more flexibility, thereby allowing the company to charge a premium price and increasing revenues.

The choices a company makes about its layout and flow's will generally have more of a supporting role to the decisions about its process and service design. As shown in Figure 2.9, there is a relationship between process types and layouts with layouts focusing on flow being more suitable for standardized, high volume and low variety processes (Slack et al., 2007). Finally, in order to achieve a high business performance, all of these decisions need be mutually reinforcing. That is, they should not be made in isolation but rather as a cohesive and comprehensive set of decisions.

2.3.1.3 Business performance

Business performance and especially business measurements play a critical role in achieving the strategic intent of the organization (Fawcett et al., 1997). More specifically, Fawcett et al. (1997) links the competitive success of an organization

to the alignment of strategic choices, measurements, and operational development. The importance of performance measurement is further supported by Letza (1996) who describes performance measures as the means of achieving control as well as a requirement in order to achieve the organizational strategy and objectives. Subsequently, McAdam and Bailie (2002) argues that performance measurements help an organization to exercise control by helping managers identifying good performance, setting targets and demonstrating success or failure.

Revenues and costs are components of most performance metrics. This thesis will thus focus on the relative impact operations strategy has on each of these. Specifically, the decisions related to operations strategy will primarily influence costs.

3

Method

The following chapter describes the methodology used in the writing of this thesis in order to provide a clear overview of the steps and thoughts related to the decisions made. The chapter consists of four sections which goes from a general perspective in terms of research strategy and design to a more applied one in terms of research methodology and quality. In each section relevant literature is presented followed by a description and discussion of the used methodology.

As defined by Kothari, 2004, p. 8 research methodology *"is a way to systematically solve the research problem."* More specifically, research methodology is related to the science of how researchers conduct research scientifically. It is not enough for scholars to know the specific methods–i.e., the methods and techniques used to conduct research–of conducting research but rather they need to develop an intuition of when and why a specific method is viable. Furthermore, each method and technique has its own inherent strengths and weaknesses and is not applicable to every problem, therefore the researcher must modify the methodology for each specific problem. Additionally, the researcher must carefully outline the choice of how to enact the research in order for others to be able to scrutinize the research (Kothari, 2004). Hence, research methodology plays a critical part in how to solve a specific research problem.

Bryman and Bell (2011) presents a set of key concepts of research, shown in Figure 3.1 below, namely; *Research strategy*, *Research design*, and *Research method*. The following sections in this chapter will explain each of these concepts in more detail.

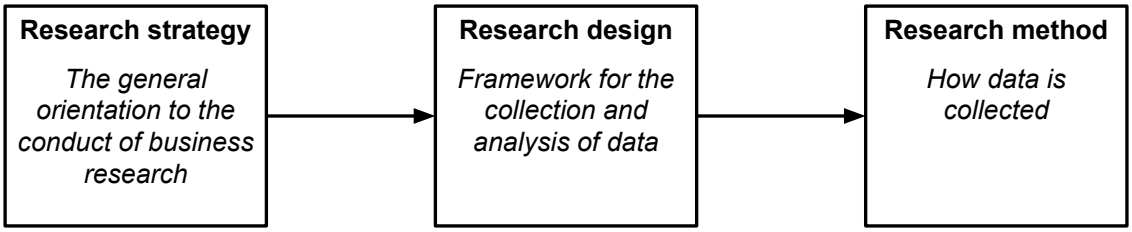


Figure 3.1: Components of research with definitions from Bryman and Bell (2011).

3.1 Research strategy

A research strategy, defined as *"the general orientation to the conduct of business research"* (Bryman and Bell, 2011, p.26), can be of two types, namely quantitative or qualitative (Bryman and Bell, 2011). These research strategies differ not only in terms of the measurements used but also in terms of the role theory has in relation to research, as shown in Table 3.1. Quantitative research strategies are deductive in nature, i.e., a hypothesis is deduced that is then subject to empirical scrutiny while qualitative research strategies are inductive, i.e., generalizable inferences are drawn from observations.

Another aspect of research strategies are epistemological considerations and their ontological orientation. Epistemological considerations refers to what can be regarded as acceptable knowledge within a discipline and can be of two doctrines; positivism that advocates the application of natural science methods and interpretivism that advocates the respect of differences between people and natural science objects and their subjective meaning. Ontological considerations are concerned with whether or not social actors can be considered objective entities or not. There are two ontological positions, objectivism that takes the position that social phenomena and their meaning are independent of social actors while constructionism asserts that these social phenomena are instead dependent on the social actors (Bryman and Bell, 2011).

As the aim of this thesis aligns with the inductive nature of qualitative studies the qualitative strategy is better suited as an overarching research strategy for this thesis. Moreover, the choice of focusing on qualitative research is further supported Bryman and Bell (2011) who presents the notion generating rather than testing a theory. The qualitative nature of this thesis has further implications for the thesis as there is a clear consideration of the influence of people's idiosyncratic meaning and social actors, e.g., the competitive strategy as well as the operations strategy is dependent on the social actor or actors implementing it. Also, the competitive landscape is highly subjective and contextual, that is, it changes depending on the lens through which it is viewed.

The purpose of research forms the focus of the project and can be to explore, to describe and/or to explain. The purpose of a research project might be of more than one type and might also change over time (Robson and McCartan, 2016). Saunders et al. (2009) defines the three possible purposes accordingly;

- **Exploratory research** focuses on what is happening and finding out new insights.
- **Explanatory research** emphasizes the study of a problem in order to explain the relationship between variables.
- **Descriptive research** aims to portray an accurate profile of persons, events or situations.

Because of the scope and research questions of this thesis, more specifically in terms of understanding the impact of different components, the purpose of this thesis is exploratory. According to Saunders et al. (2009), this is particularly useful if one wants to clarify their understanding of a problem and has the advantage of being flexible and adaptable to change. As no hypotheses have been stated the purpose of this thesis is not explanatory but rather exploratory.

Table 3.1: Differences between quantitative and qualitative research strategies (Bryman and Bell, 2011).

	Quantitative	**Qualitative**
Theory's role in research	Deductive; testing of theory	Inductive; generation of theory
Epistemological orientation	Natural science model, in particular positivsm	Interpretivism
Ontological orientation	Objectivism	Constructionism

3.2 Research design

A research design "*provides a framework for the collection and analysis of data*" (Bryman and Bell, 2011, p. 40). To put it another way, a research design is "*a logical plan from getting from here to there*" (Yin, 2011, p. 26), i.e., from a set of questions to a set of conclusions.

Robson and McCartan (2016) have developed a framework for research design, shown in Figure 3.2, that consists of five dimensions; purpose, conceptual framework, research question(s), methods and sampling strategy. Both the purposes and the conceptual helps specify the research question(s), while the research question(s) aids in the decision-making of which methods and sampling strategy to use. Using this framework for research design has the advantage of showing potential mismatches between the different components of the framework, for example if the research question(s) do not link to the conceptual framework. Subsequently, this thesis will use a research design adopted to Robson and McCartan (2016)'s framework as shown in Figure 3.2 below.

Bryman and Bell (2011) defines five types of research designs, namely;

- **Experimental design**: entails the manipulation of an independent variable in order to determine its effect on the dependent variable.
- **Cross-sectional design**: entails the collection of data on multiple cases at a single point in time.
- **Longitudinal design**: a sample is surveyed at multiple points in time. A

longitudinal design can be either a panel study or a cohort study with the difference being whether or not the sample is randomly selected or whether it consists of individuals that share certain characteristics.

- **Case study design**: entails the detailed study of a single case. A case can be either an organization, a location, a person or an event.
- **Comparative design**: involves comparing two cases using practically identical methods. A comparative design can be both quantitative and qualitative.

The thesis is conducted in cooperation with the case company and will therefore also focus on the study of the case company and its direct environment. The thesis will explore and use the case company as an example and application of the conceptual framework. In each of the different aspects of the presented conceptual framework in section 2.3 *Conceptual model*, the case company's specific situation is analyzed in order to provide a tangible application of the framework. Consequently, the research design of this thesis is thus a case study design.

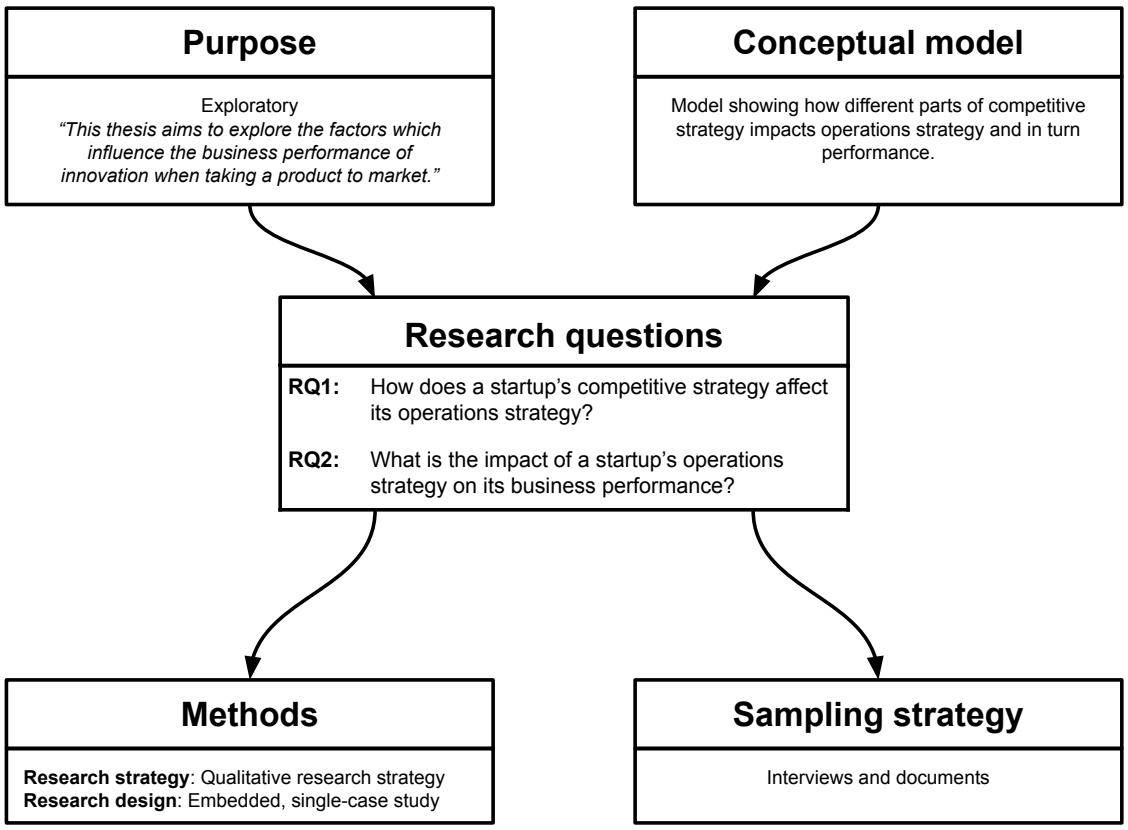


Figure 3.2: Research design framework by Robson and McCartan (2016) applied to this thesis.

3.2.1 Case studies

As defined by Woodside (2017) case studies is "*an inquiry that focuses on describing, understanding, predicting, and/or controlling the individual (i.e., process, animal, person, household, organization, group, industry, culture, or nationality)*" with the principal word being individual, i.e., the focus is on studying a smaller amount of subjects for a longer time than studying a greater number of subjects for a shorter time. Furthermore, Woodside (2017) argues that the main goal and purpose of any case research study should be a deep understanding of actors, interactions, sentiments, and behaviors for a specific process through time.

This thesis, as described previously, aims to explore the factors which influence the value capture of innovation when taking a product to market. In extension, this thesis aims to explore and help to gain a deep understanding of the interactions and behaviors of competitive and operations strategy that affect the business performance for a manufacturing startup. Hence, it is aligned with the goal and purpose of gaining a deep understanding.

According to Yin (2011), a case study can be of four types, being either holistic or embedded as well as either of a single- or multiple-case design. This thesis is an embedded, single-case study since it is conducted with and on behalf of the case company and will include more than one unit of analysis in terms of analyzing the impact of both the case company's competitive and operations strategy.

Case studies possess several strengths and weaknesses. Eisenhardt (1989) suggests that some of the inherent strengths of case studies include; (1) the theory build from cases is most likely to be novel since it builds upon the juxtaposition of different types of data and evidence, (2) the theory is likely to be testable with constructs that can easily be measured as well as hypothesis that can be proven false, and (3) the resulting theory is likely to be empirically sound since the building of the theory is intertwined with evidence. However, Eisenhardt (1989) also suggest a number of weaknesses of case studies, namely; (1) the intensive use of empirical evidence can lead to an exceedingly complex theory, and (2) it may lead to a theory that is narrow and idiosyncratic.

3.3 Research method

The research method refers to how data is collected (Bryman and Bell, 2011). For qualitative research, Bryman and Bell (2011) presents six main steps as shown in Figure 3.3.

The six main steps are largely sequential. However, there are two sub-steps, 5a and 5b, for narrowing down and further specifying the research questions and thus guiding further collection of data. According to Easterby-Smith et al. (2015), the choice between whether theory or data is influenced is determined by the fact that the relationship between the two needs to be an interactive process, e.g., surprises in

the collection of data should be compared to existing literature and new literature might impact the data collection.

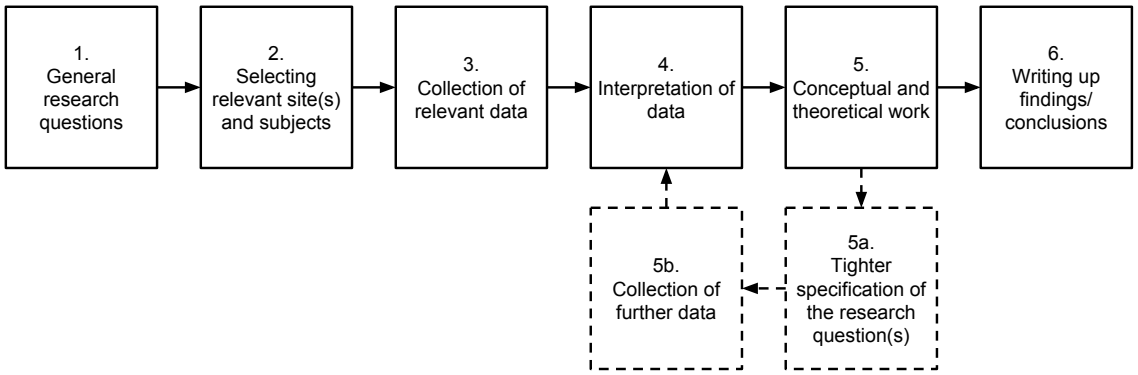


Figure 3.3: Steps in qualitative research, adopted from Bryman and Bell (2011).

This thesis largely followed the process presented by Bryman and Bell (2011), shown in Figure 3.3, although a few of the steps were done in a different order as shown in Figure 3.4. For example, that the thesis would be conducted with the case company had been decided before research questions were formulated. Additionally, a conceptual model was created based on a literature review before data was collected, although this model was revised as data was collected, interpreted and analyzed.

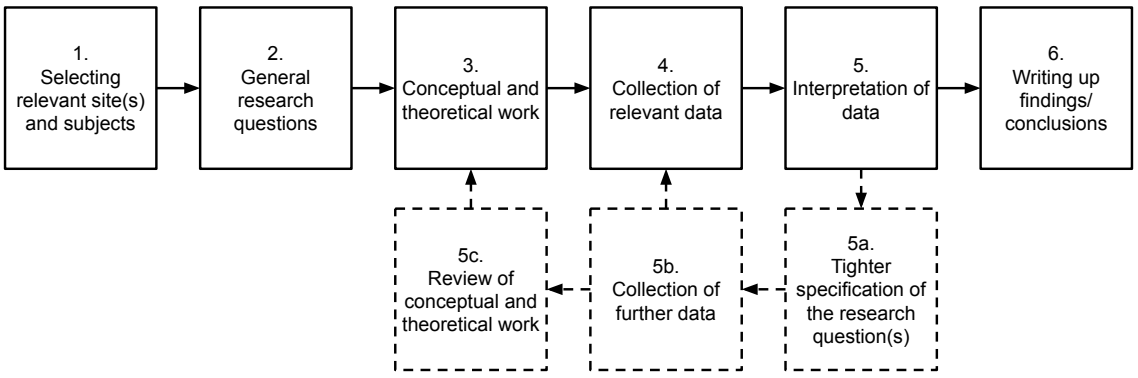


Figure 3.4: Steps in qualitative research adapted to this thesis, adopted from Bryman and Bell (2011).

The reason for performing the conceptual and theoretical work before the collection and interpretation of data was to create a conceptual model that could later be used to both guide data collection as well as to interpret and analyze the collected data. Additionally, an additional step was performed in order to allow for the revision of the conceptual and theoretical work based on the collected data. The following sections will describe the three main parts of the research, namely; the conceptual and theoretical work, the data collection, and the interpretation and analysis of data.

3.3.1 Conceptual and theoretical work

A literature review is one of the most important tasks in doing research and provides the basis for the research questions and the research design. Additionally, it also informs how to collect and analyze data in an informed way. There are multiple purposes of doing a literature review with some of the main ones being to find out what is already known about the subject, what theories and concepts there are, whether or not there are any controversies, what research methods and strategies have been used previously, and whether there are any unanswered research questions in the area (Bryman and Bell, 2011).

Easterby-Smith et al. (2015) presents two types of literature reviews; traditional literature reviews which summarizes literature and draws conclusions about the topic and systematic literature reviews which aims to identify, evaluate and synthesize all relevant literature on a given topic. According to Bryman and Bell (2011), systematic review aims to minimize bias in literature review's by describing the reviewer's process in a transparent way in order to allow for replication and consists of three main steps.

However, despite the advantages of using a systematic review, Bryman and Bell (2011) mean that it might be unfeasible for student research projects and that the approach can lead to excessive bureaucracy. We therefore chose to conduct a traditional literature review rather than a systematic one. The literature review started with a general outline and summary of the literature that was deemed to be relevant to the topic, followed by a more detailed examination of each of the components presented in chapter 2. The literature review aimed to develop a conceptual model, shown in Figure 2.10, in order to allow for an analysis of collected data. Furthermore, the conceptual model also serves the purpose to guide the subsequent analysis of data, that is, it provided clear demarcations of how and in what order the collected data was analyzed.

3.3.2 Data collection

Data collection is about using the selected methods of investigation in a systematic and professional fashion. Without data there is no research project (Robson and McCartan, 2016). Data collection is therefore an important part of any research project.

Yin (2011) defines six sources of evidence for case studies; direct observations, interviews, archival data, documents, participant observations and physical artifacts. This thesis primarily used interviews and documents as sources of evidence. Furthermore, these types of data are usually named qualitative data which is defined by Easterby-Smith et al., 2015, p. 129 as; *"pieces of information gathered in a non-numeric form."*

This thesis used both primary, secondary and tertiary sources of data. Primary data consisted of interviews with employees of the case company, while different types of

documents were used as secondary and tertiary sources of data. As can be seen in Table 3.2, secondary data in the form of documents were of many types, e.g., annual reports from studied companies, indices and other statistical data while tertiary data consisted of market reports.

Table 3.2: Category, type and reference of data collected for analysis.

Category	**Type of data**	**Reference**
Primary data	Interview	Case company, unstructured interview, 2019-03-25a
		Case company, unstructured interview, 2019-03-25b
Secondary data	Annual report	Competitor B (2018, 2015)
		Competitor A (2019)
		Competitor D (2019)
		Competitor E (2019)
	Information	Almi (2019)
		Chalmers Ventures (2019)
	Report	Ministry of Enterprise and Innovation (2016, 2017)
		Ministry of the Environment and Energy (2018)
		United Nations (2004, 2015)
		Edfeldt and Damsgaards (2015)
		Radgen and Blaustein (2001)
		Schwab (2018)
		Bosma and Kelley (2019)
		Dvořáček (2010)
		Sousa De Vasconcellos and Hambrick (1989)
		Turner & Townsend (2018)
		Cushman and Wakefield (2018*c*,*a*, 2017, 2018*b*)
		Comin (2006)
	Financial data	Yahoo Finance
	Patents	Google Patents
	Indices	Park (2008)
		Global Innovation Policy Center (2019)
		A.T. Kearney (2014)
		The World Bank (2018*a*,*b*)
		World Economic Forum (2016)
	Statistical data	Eurostat (2019*b*)
		Global-production Inc. (2018)
		International Labour Organization (2019)
		Damodaran (2019, 2018, 2017, 2016, 2015, 2014)
		KPMG (2018)
		Statista (2019*a*)
		International Monetary Fund (2019)
		University of Groningen (2015)
		Veson Nautical Distance (2019)
		Bloomberg (2019)
		OECD (2001, 2009, 2018*a*)
Tertiary data	Market report	MarketsandMarkets (2016)
		Dun&bradstreet (2018)
		MarketLine (2018*a*,*b*,*c*,*d*,*e*)
		MarketLine (2019*a*,*b*)
		Wiman Ohlson and Montalvo Kai (2018)

3.3.2.1 Interviews

In terms of data collection through interviews, there are three main types of interviews (Saunders et al., 2009, Robson and McCartan, 2016) which can be paired the three types of interviews to the different types of research design in terms of frequency of use (Saunders et al., 2009). As can be seen in Table 3.3, unstructured interviews are most frequently used followed by semi-structured interviews.

One type of unstructured interviews is non-standardized, open-ended and in-depth. This type of interview can be difficult for novice researchers to use (Robson and McCartan, 2016). In semi-structured interviews, the researcher will have a list of subjects to cover, but these may vary from interview to interview (Saunders et al., 2009). According to Easterby-Smith et al. (2015), both semi-structured and unstructured interviews are appropriate methods when the following conditions apply; (1) the aim of the interview is to develop an understanding of the respondent's world, (2) it is necessary to understand the reasons for the respondents beliefs about a particular subject, and (3) the subject is highly confidential or commercially sensitive. Based on these criteria, both semi-structured and unstructured interviews are appropriate methods for this research.

Table 3.3: Use of each of the interview types in the different research purposes (Saunders et al., 2009)

	Exploratory	Descriptive	Explanatory
Structured		✓✓	✓
Semi-structured	✓		✓✓
Unstructured	✓✓		
✓✓= more frequent, ✓= less frequent			

During this thesis, we exclusively interviewed employees of the case company. The purpose of these interviews was twofold; firstly, to gain an understanding of the choices the case company had already made with regards to its competitive strategy and the reasoning behind these. Secondly, the interviews served as sources of data about the case company's product and the CAS industry. Table 3.4 shows who at the case company was interviewed, their role at the company as well as how many and what type of interviews were conducted.

Table 3.4: Interviews conducted during this thesis.

Interviewee	**Role**	**Number of interviews conducted**	**Type of interview**
Employee A	Founder and CEO	1	Unstructured
Employee B	Business developer	2	Unstructured

Interviews on the other hand are targeted in terms of focusing directly on the case study topics as well as having the possibility of being insightful by providing perceived

causal inferences. However, interviews requires a skilled interviewer in order to avoid bias from responses and poorly articulated questions, poor recall as well as the risk of the interviewee simply providing the answers he or she thinks the interviewer wants (Yin, 2011).

3.3.2.2 Documents

As presented in Table 3.2, documents were of many types and thus collected from various sources, e.g., annual reports were collected from company websites, indices were primarily collected from online databases, while reports and market reports were collected both through online resources such as Google Scholar and the Chalmers library service Summon as well as through other online databases.

Documents have the advantage of being repeatedly review-able, exact and having a broad coverage. However, they might be difficult to find, access might be limited and there might be bias in terms of selectivity and reporting. Scott (2014) suggests four criteria to assess the quality of documents; authenticity, credibility, representativeness and meaning. In the writing of this thesis, all of these factors were taken into consideration by always aiming to find the original source (authenticity), reviewing the number of citations for journal articles (credibility) and reading several articles on the same topic (representativeness and meaning).

3.3.3 Interpretation and analysis of data

After data has been collected, it has to be analyzed and interpreted. Analysis and interpretation differs in terms of the purpose of analysis being to search for causes while interpretation aims to shed light on meaning (Robson and McCartan, 2016). An analysis of data is necessary since raw data does not generally speak for themselves.

For case studies in particular, Yin (2011) presents five analytic techniques for analyzing case study evidence, namely.

- **Pattern matching**: An empirically based pattern is compared with a predicted one. If the patterns match, the research project's internal validity can be strengthened.
- **Explanation building**: The case study data is analyzed by building an explanation about the case.
- **Time-Series Analysis**: An observed trend is matched with a theoretically significant trend specified before the case study.
- **Logic Models**: Empirically observed events are matched to theoretically predicted events in sequential stages.
- **Cross-Case Synthesis**: Multiple cases are analyzed with each separate case being treated as a separate study.

Additionally, other authors (e.g., Robson and McCartan (2016)) present other approaches. However, the authors provide a list of common features for qualitative data analysis as given by Miles et al. (1994), namely; labelling, adding comments and reflections, identifying patterns and using these for further data collection, elaborating on generalizations and linking these to theory.

For this thesis, data was interpreted and analyzed primarily through the features presented by Miles et al. (1994). In particular, the interpretation and analysis of data related to the supply network design was commented on and used for further data collection, e.g., the interpretation of one parameter was used to analyze the meaning of another. Furthermore, the analysis was linked to theory through the conceptual model presented in Figure 2.10.

Specifically, the impact of operations strategy on business performance was estimated by calculating the relative impact of a set of scenarios on the case company's current cost structure as shown in Appendix A.10. For example, the impact of offshoring accounted for the different cost components and how locating operations in one country impacted these, e.g., how the labor part of manufacturing costs decreased while transportation costs increased for certain countries. Furthermore, the change in cost structure with increasing volume was calculated in a similar way, e.g., how learning effects decreases the unit cost of manufacturing by 20-30% for each doubling of accumulated experience or how economies of scale decreases the unit costs of equipment by a little over one third.

3.4 Research quality

Bryman and Bell (2011) present three criteria for evaluation of business and management research in particular, namely; reliability, replicability and validity. These concepts will be explained in more detail in the following sections and the specific impact of these on this thesis will be discussed.

3.4.1 Reliability

Reliability within research refers to whether or not the results are repeatable. More specifically, for qualitative studies reliability can be categorized according to external and internal reliability. External reliability refers to the degree to which a study can be replicated, while internal reliability refers to whether or not multiple observers agree on what they see and hear (Bryman and Bell, 2011).

As pointed out by Bryman and Bell (2011), reliability is especially difficult to achieve when conducting qualitative research since it is basically impossible to 'freeze' the conditions under which the research was conducted. We aimed to improve this study's reliability by developing the conceptual model shown in Figure 2.10 and having it be applicable to other companies in other settings.

Additionally, the reliability of the thesis was strengthened by using primarily primary and secondary sources of data as seen in Table 3.2. The term primary data source is considered to include all data that is collected firsthand for a specific purpose (Salkind, 2010). In contrast, a secondary data source considers data that already exists and is being used differently than originally intended or by someone else than the researcher that collected the original data. Primary data provides an uninterrupted and unobstructed path to the original data source. Hence, it is the closest data source to original data. On the other hand, the secondary is not as close to the original data source as primary data but can nonetheless be valuable (Salkind, 2010). Furthermore, primary data may be deemed more advantageous in comparison with secondary data as affirmed by Salkind (2010). Some of the advantages are; primary data is the purest form of data, aggregated forms of data do often not provide sufficient granularity, secondary data sources pertaining to the challenge of quality of data, and the secondary data may be distorted as it has been used several times.

Primary data do not adhere to the same challenges as secondary data as the researcher have control over the aggregation, quality, and elimination of distortion. Nevertheless, despite the inherent disadvantages of secondary data sources they do provide some compelling advantages (Allen, 2017), namely; secondary data sources provide significant time savings, secondary data sources are easily accessible through various databases, secondary data sources allow for a breath of research in comparing and contrasting data from multiple sources.

This thesis relies heavily on secondary data because of the clear advantages. If secondary data would not have been utilized, the scope of the thesis would have had to be reduced significantly in scope, not only due to the numerous areas covered but also due to the time available.

3.4.1.1 Ethical and political considerations

One aspect of validity that is applicable to this thesis is the concept of ethical and political consideration. As in other settings, research and researchers are affected by political behavior. According to Sandström (2017), the reason for ideas, research, and innovations to diffuse is that they are aligned with the current beliefs of the community. The community is made up of several bodies of people; (1) fellow academics which support the research, (2) the corporate community of firms which have a monetary interest in the research, (3) the societal community which accept the research. The fist two stakeholder communities is also supported by Easterby-Smith et al. (2015). Thus, if the research is not aligned with the above-mentioned communities it could face issues.

Moreover, politics in an innovative and organizational setting has been defined by Hardy and Dougherty, 1997, p. 17 as *"[...] power in a deliberately neutral and simple fashion: as a force that affects outcomes. Politics is simply power in action."* This power that can be asserted on or by academics is vital to be aware of as well how

it might affect the research. Correspondingly, Easterby-Smith et al. (2015) argues that scholars should not try to hide the politics and their influence on research but rather they should be incorporated within the research by carefully reflecting on how one might be affected by the political agenda of current setting. In accordance, we regularly reflected on the current setting and how it affected us, especially when collecting data and developing the final framework.

A specific problem relating to the thesis is the alignment of organizational goals and needs with academic goals and achievements. We believe that these two are not mutually exclusive, as noted by Easterby-Smith et al. (2015), but can be achieved simultaneously. This aspect was thus remedied both by communicating the demarcations presented in section 1.5 *Demarcations* as well as through the use of regular meetings and discussions with the case company about the progress of the work and the conclusions drawn.

3.4.2 Replicability

Replicability refers to whether or not the procedure of the research has been properly explained in order to allow other researchers to reach the same results by following the same procedure (Bryman and Bell, 2011). Although replicability is especially difficult for qualitative research because of the researchers predilections (Bryman and Bell, 2011), we aimed to strengthen the replicability of this thesis by clearly spelling out the procedures used during the writing of this thesis as proposed by Bryman and Bell (2011). However, the request of the case company to keep certain information confidential will have implications on the replicability of the thesis.

3.4.2.1 Confidentiality

The case company is working in an environment where it is crucial to protect its innovation and how it might affect the market in terms of the company's future position and competitors. As noted by Grant (2016), key determinants for capturing the value of an innovation can be related to the ability to establish property rights, tacitness or complexity of the innovation, lead time, and complementary resources. Subsequently, it is vital that the information that will provide the foundation of the thesis remain confidential.

The presence of confidential information in this thesis means that it will be difficult for other researchers to replicate the same results because some information has been censured. Hence, the replicability is lowered. However, because the conceptual model presented in Figure 2.10 was developed with the goal of being generalizable, similar studies would hopefully be able to reach similar conclusions.

3.4.3 Validity

Validity refers to the integrity of the conclusions from the research. Validity can be of many types, where the main ones are measurement validity, internal validity, external validity and ecological validity. Measurement validity is concerned whether or not a measurement actually reflects the concept that it is supposed to. Internal validity is closely related to the concept of causality and whether or not there is a causal relationship between two variables. External validity is concerned with whether the results of the research can be generalized beyond the specific research context. Ecological validity refers to whether the results of the research are applicable to everyday settings (Bryman and Bell, 2011).

The concept of measurement validity as presented by Bryman and Bell (2011) can be likened to construct validity as presented by Yin (2011). Yin (2011) presents three principles of data collection in order to deal with the problems of construct validity; using multiple sources of evidence, creating a case study database, and maintaining a chain of evidence. This thesis used all three principles; both documents and interviews were used as sources of data, the collected data was stored and organized in the reference manager software *Mendeley*, and citations were made in the APA format in accordance with Chalmers master's thesis guidelines.

For case studies like this thesis, Bryman and Bell (2011) brings up the concern of external validity for case study research, that is, whether or not it is possible to generalize form a single case. The authors therefore argue that instead of claiming a degree of theoretical generalizability, a case study should focus on the uniqueness of the case and on developing a deep understanding of its complexity. However, Yin (2011) argues that case studies are generalizable to theoretical propositions but not to populations or universes. The conceptual model shown in Figure 2.10 is trying to bridge these two concerns by being developed with the aim of being generalizable to theoretical propositions but also by being applied to the case company and its context.

4

Analysis

The following chapter will present and analyze data in order to answer the two research questions presented in section 1.4 Research questions. Furthermore, the chapter will follow the structure above as presented in chapter 2. The analysis will present data gathered through secondary or tertiary sources such as annual reports, presentations, and reports and primary data such as interviews with the case company continuously rather than in separate sections. Moreover, the primary data gathered from unstructured interviews with the case company serves primary as a way of exemplifying the analyzed secondary and tertiary data. This chapter will for each section first present data followed by an analysis of the data and a result that will answer the research questions.

4.1 Competitive strategy

The competitive strategy of the industry as well as that of the case company, as defined in section 2.3 *Conceptual model*, results in a set of key success factors, i.e., reliability, efficiency and investment cost, which impacts the operations strategy. The subsequent analysis of the competitive strategy will try to answer how the key success factors impact the operations strategy and how each of the components of competitive strategy impact the key success factors. The anticipated result is a clear understanding of how the competitive strategy of a startup impacts its operations strategy as set out in section 1.2 *Aim* and section 1.4 *Research questions*.

Although the case company's competitive strategy is being treated as fixed, it is still analyzed in order to help answer *RQ1* and in order to determine its impact on a company's operations strategy. The analysis covers each of the defined components of Competitive strategy, more specifically Corporate strategy and Business strategy of the competitive landscape. The analysis will also include the underlying factors specified for both Corporate strategy and Business strategy. An overview of the structure of the analysis can be seen in Figure 4.1.

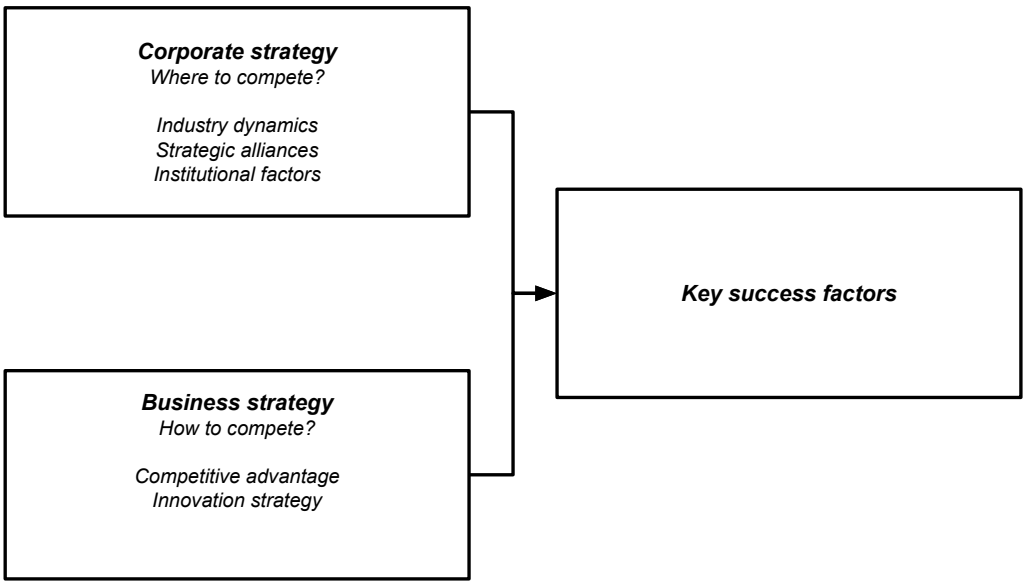


Figure 4.1: Overview of Competitive strategy and its components.

4.1.1 Corporate strategy

As presented in subsection 2.1.1 *Corporate strategy*, the corporate strategy of a company is mainly concerned with the overall scope of the firm in three dimensions; geographically, product wise, and degree of vertical integration. Furthermore, as corporate strategy has a significant impact on the business performance of a company it is therefore of interest for any manufacturing company to analyze how the separate dimensions of the corporate strategy affect the business performance as well as the impact on key success factors and subsequently the impact on operations strategy. Next is a careful analysis of the independent underlying dimensions of the corporate strategy. Predominantly, as defined in subsection 2.1.1 *Corporate strategy*, there are three dimensions which will be analyzed.

Firstly, industry dynamics determines the attractiveness of the industry and its profit potential. As shown in Figure 2.10, operations strategy is positioned before any profit can be accrued; hence the industry dynamics must also impact the operations strategy. The analysis of the structural components will support how the operations strategy is affected through the key success factors. Secondly, the strategic alliances which the firm does or does not partake in can affect, as previously covered in subsubsection 2.1.1.2 *Strategic alliances*, the knowledge, capital, and opportunities available to the firm and therefore also impact the operations strategy. Thirdly, the institutional factors can make or break a firm's success and thus also impacting the operations strategy.

Specifically for the case company, the CAS industry it is trying to enter consists of ten market segments, categorized according to industry. The three largest ones are manufacturing, oil & gas and chemical & petrochemicals that account for 17.0%, 15.8% and 15.2%, respectively (MarketsandMarkets, 2016). Geographically, Europe

accounts for approximately one fifth of the total industrial compressed air market. However, it is expected to have the slowest demand growth out of all the global markets (MarketsandMarkets, 2016). The Swedish market can be estimated to less than 1-2% of the European market (see Appendix A.2 for estimation details).

4.1.1.1 Industry dynamics

The CAS industry is capital intensive with large entry barriers (MarketsandMarkets, 2016, Dun&bradstreet, 2018) which has led to a market that is both concentrated at the high end and fragmented at the lower end of the market. On the global level, it is dominated by a few large players that hold 25% (MarketsandMarkets, 2016) of the total market and on the local level it is characterized by fierce competition, e.g., the U.S. market is highly fragmented as the largest 50 companies account for 75% of the total market (Dun&bradstreet, 2018). Additionally, the analysis will focus primarily on the five largest players within the industry which holds 25% of the total industry and therefore are of particular interest. Globally, the drivers of the industry include the industrialization in emerging economies, rising energy consumption, increasing demand for more efficient solutions as well as expansion in the U.S. and Australia. However, there are challenges in terms of noise pollution and strict quality standards from manufacturers (MarketsandMarkets, 2016).

The rivalry between competitors is the most notable force since the industry is both consolidated and fragmented at the same time. Additionally, the industry is in a mature phase with a growth between a high of 6.3% (MarketsandMarkets, 2016, Dun&bradstreet, 2018) and an estimated low of 2.2% (estimation of market growth can be seen in Table A.4 in Appendix A.3). Also increasing the competitiveness between firms is the fact that the products are equal and undifferentiated. However, the fact that several of the main competitors are highly diversified firms with their revenues coming from the engagement in different activities and industries lowers the competitiveness between rivals as they have a split focus.

Looking at the specific competition and its potential effect on the case company and subsequently on a startup in general provides a somewhat distorted image since the major players can assert significant industry pressure on specific geographical segments of the industry in combination with pressure from local players. For example, the case company's greatest threat is Competitor B which has a significant part of the total market, thus having significant volumes and is likely to enjoy economies of scale. Consequently, the moderate to high threat of competitive rivalry is likely to increase the focus on; (1) the reliability as in order to outperform the rivalry from the incumbents the smaller players need to match and surpass the incumbent's reliability, and (2) the investment costs as the incumbent's volumes are greater and can therefore provide a more competitive price.

The threat of buyers or buyer power within the CAS industry is considered to be moderate mainly due to the fact that the CAS industry in turn serves a large number of different industries. The products are used in almost every area from

mining to manufacturing as well as by consumers and has a long life span. The average life span for an industry compressor is between 13 and 16 years (Radgen and Blaustein, 2001), reducing the number of compressors bought by each customer and therefore decreasing the threat of buyers. Besides, as the products are so widely used the threat of a buyer backward integrating is considered to be low to non-existent further decreasing the threat of buyers. However, the low switching costs of buyers (MarketLine, 2018*d*,*e*) somewhat increase buyer power.

The low to moderate degree of buyer power within the CAS industry implies that the threat of buyers is not a major determining factor of the overall intensity of the industry. However, the relative ease for customers of switching between industry solutions results in an increased focus on investment costs since the industry solutions are relatively similar in their design and assuming the reliability criteria is meet.

The threat of suppliers is considered to be low to moderate as the material supplied by the suppliers are to a large extent commodities such as steel, copper, and aluminum. Additionally, purchased components include bearings, gaskets and seals, castings, forgings, and motors (Dun&bradstreet, 2018). Moreover, the threat of suppliers is low because of generally high profits, such as e.g., the mining industry which has historically seen a relatively high ROE, around 15% (Grant, 2016). This means that suppliers are less inclined to forward integrate as a way to achieve additional profits and because there exist no clear synergies or transaction specific investments. Finally, the threat of suppliers is further weakened by the low switching costs between suppliers (MarketLine, 2018*d*,*e*).

The low to moderate threat of suppliers imply that it is not a significant determinant of the industry intensity. However, the threat of suppliers is not to be neglected. As the goods supplied by the suppliers are commodities, this could affect the key success factor of reliability as well as efficiency. Reliability is likely to be affected as firms are likely to search for the best available materials for the lowest possible price. Hence, the focus on both reliability and efficiency and also the performance objective of quality and dependability is slightly increased.

The threat of new entrants is considered to be low to moderate. The foremost factors that influence the low risk of new entrants are the considerable amount of capital needed in order to break into the market (MarketLine, 2018*e*). Furthermore, since the top five companies within the industry holds 25% of the total market they will most likely retaliate if there is a threat of a new entrant. However, two factors which increases the threat of new entrants are the low switching costs of the industry and the low demand-side network effects.

The low to moderate threat of new entrants imply that the threat of new entrants is a major determinant of the overall intensity of the industry. As mentioned in subsubsection 2.1.1.1 *Industry dynamics*, it is the potential threat of entries that impose restrictions on the profitability of the industry. Hence, the considerable amount of capital needed to break into the market limits the profitability and therefore increases the focus on efficiency. If the barriers to entry increases, it would

most likely increase the importance of all of the key success factors.

The threat of substitution can be considered low, primarily due to the fact that CAS are widely used in a number of industries. Furthermore, Radgen and Blaustein (2001) states that around 10% of all energy consumed within the industry setting is due to CAS. Additionally, CAS are advantageous in the sense that they are safe and easy to use (Radgen and Blaustein, 2001). Another important factor which reduces the threat of substitution is the high degree of risk avoidance of buyers. According to Radgen and Blaustein (2001) the most important performance criteria is the reliability of the system, asserting the risk avoidance of buyers. Furthermore, in the cases where electricity can be used as an alternative energy source to compressed air it is not only beneficial but there are some substantial drawbacks as well. For example, electrical tools are bigger, heavier, and vibrates much more which can impair the workers' ergonomics (Case company, unstructured interview, 2019-03-25b).

The low threat of substitutions imply that the threat of substitutes only has a minor impact on the overall intensity of the industry. As there exists a limited set of available substitutes within the CAS industry the impact on the profitability is only minor. If there existed more alternatives the affected key success factor would depend on the ease of substitutability. Assuming that the substitute can provide the same function as the original solution, it is more likely that it would increase the importance of investment cost rather than reliability. However, if the reliability criteria are not met this would increase more rapidly than investment costs. Hence, for the CAS industry, using electric tools and machinery as a substitute is more likely to increase the key success factor of reliability as they have clear drawbacks in relation to pneumatic tools and machinery.

Table 4.1 shows the strength as well as the impact for each of the five forces. Furthermore, each of the assessed forces are plotted in Figure 4.2 to depict the overall industry intensity. The figure provides a representation of the CAS industry intensity and therefore also indicate the profit potential within the CAS industry. Taken together the five forces asserts a moderate force on the industry, thus indicating that the possibility of profitability within the industry is also moderate in accordance with Porter (2008*b*), thus allowing players within the CAS industry to capture a notable portion of the total industry profit potential. Furthermore, the structural foundation that is the aggregate of the five forces can be used to anticipate changes that might affect the firm's strategic position as suggested by Grant (2016). For a more in depth view of the scoring of each independent factor see Appendix A.4.

Table 4.1: Summary of Five forces analysis.

Force	**Strength**	**KSF Impact**
Competitive rivalry	High	Reliability and investment costs
Buyers	Low to moderate	Investment costs
Suppliers	Low to moderate	Reliability and efficiency
New entrants	Low to moderate	Efficiency
Substitutes	Low to moderate	Reliability

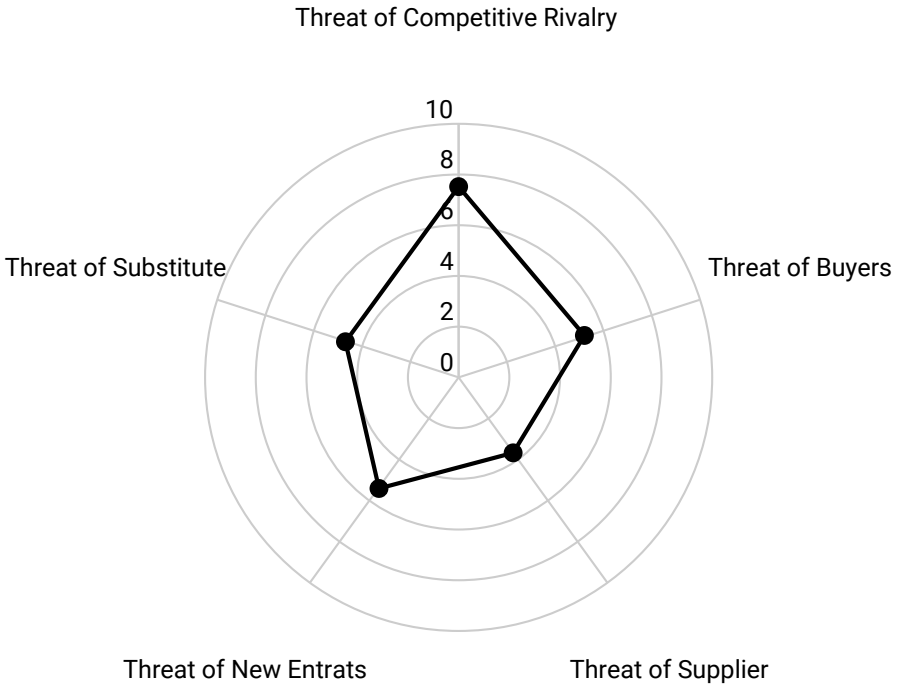


Figure 4.2: Assessment of Porter's five forces within the CAS industry.

Note: The figure shows the intensity asserted on the industry from each force on a scale from zero to ten with zero being the lowest and ten the highest, thus providing an indication of where the locus of the firm should lie in order to shelter it from being affected by the forces.

Assuming the moderate intensity of the industry, it is likely that industry players are able to pursue diverse strategies since a lower industry intensity allows firms to pursue other strategies than price cutting. If the intensity within the industry would increase it is probable that the diverse strategies seen today would shift towards a focus on price cutting. An increased intensity also makes it likely that a shakeout of players would occur due to the inability for smaller companies to produce goods with sufficient economies of scale.

4.1.1.2 Strategic alliances

Competitors to the case company are utilizing strategic alliances to their advantage. For example, one of the case company's main competitors entered two joint ventures and announced one partnership in 2017. Specifically, this competitor uses partnerships to increase competence and for the production of non-critical components (Competitor B, 2018). Furthermore, the usage is not only limited to one or two of the major competitors. As shown in Table 4.2, almost all of the major competitors are in some way utilizing strategic alliances to enhance their competitiveness, new product development, and knowledge. For example, Competitor E recently increased their cooperation with an industrial company and launched a joint venture (MarketLine,

2018*c*) while Competitor A extended its cooperation with a large manufacturing company with the joint goal of increasing both of the companies competitiveness (MarketLine, 2019*a*). Additionally, the main competitors are collaborating in terms product developed where e.g., Competitor C has launched several collaborations related to research and development (MarketLine, 2019*b*).

Table 4.2: Examples of strategic alliances for main competitors.

Company	**Type of strategic alliance**
Competitor A	Manufacturing
Competitor B	Competence and manufacturing of components
Competitor C	Research and development
Competitor E	Manufacturing

Source: MarketsandMarkets (2016) and competitor annual reports.

For the case company, there are primarily two types of knowledge that are necessary; knowledge related to the technical performance of the product and knowledge related to the production of the products. These two types of knowledge would allow the case company to improve its performance and lower its costs. Out of these two primary types of knowledge, the case company is currently performing very well in terms of technical performance, evident from the fact that its product is more efficient than competing products on the market (Wiman Ohlson and Montalvo Kai, 2018). The ability of strategic alliances to increase efficiencies, accessing new or critical resources or capabilities and the ability to enter new markets are therefore of primary interest to the case company (Case company, unstructured interview, 2019-03-25a). The founder and CEO of the company is also the inventor of the product and owner of the patent around it which means that this knowledge is still kept within the company. However, as mentioned in subsection 1.1.1 *Company profile*, the case company is lacking experience in production. Since none of the employees within the company has any previous experience in production, either in person or in terms of managing it.

In terms of strategic alliances' ability to access new or critical resources or capabilities, this is particularly attractive to the case company because of its lack of knowledge related to the production of its products and the importance of this in its future success. More specifically, the case company would need the access capabilities that allows it to reliably produce quality products at a low unit cost. The alliance partner would benefit from the revenues the production of the case company's products. Hence, the ability of strategic alliances to increase efficiencies is appealing to the case company because of the competitiveness of the industry and the subsequent belief that unit costs will be an important factor (Case company, unstructured interview, 2019-03-25b). Partnering with another company would allow the case company to share fixed costs and thus faster be able to utilize economies of scale in its production.

Strategic alliances' ability to help firms enter new markets is appealing to the case company as it seeks to expand geographically in the future (Case company,

unstructured interview, 2019-03-25a). Furthermore, as presented in subsection 4.1.1 *Corporate strategy*, the Swedish market can be estimated to be 1-2% of the European market meaning that the case company has limited growth potential if it were to simply operate within its home market.

In conclusion, based on the data presented in Table 4.2, strategic alliances could help the case company access complementary resources and consequently achieve the key success factor of low investment costs by lowering the unit costs of production, thereby allowing the case company to sell its product at a lower price to customers. Furthermore, since the case company is currently lacking production capabilities, strategic alliances can help with accessing these capabilities and thus positively impact its ability to achieve the key success factors related to product performance. However, the case company's reluctance to give up control of technical development means that strategic alliances are an unlikely vehicle to help with key success factors related to product performance. The strategic choice of creating a strategic alliance may affect the firm's operations strategy indirectly since the interdependency and control will consequently affect reliability, efficiency and investments costs.

4.1.1.3 Institutional Factors

As mentioned in subsubsection 2.1.1.3 *Institutional factors*, firms that do not align with the institutional factors within the market will likely suffer from an inferior performance. For the case company, there are three primary factors that influence it; certification requirements, sustainability aspects and the startup environment.

Certification requirements
The presence of certification requirements within the CAS industry can provide essential means of achieving a competitive advantage but also impair performance for those that do not align their strategy with the institutional factors within the market. The case company clearly states that the currently enforced rules significantly influence them (Case company, unstructured interview, 2019-03-25b). Specifically, the case company is primarily affected by the need to comply with CE markings as it not only imposes strict rules for the production of machines but also imposes rules during the prototyping phase. Subsequently, the capital intensive process of having to conform to the CE legislative directive affect the case company (Case company, unstructured interview, 2019-03-25b).

It is likely that the institutional factors affect the performance of the CAS industry since the rules of the game increases the performance demanded from customers. Specifically, new regulatory frameworks increases governmental pressure on performance, for example in the form of CE-markings. This increases the capital needed to develop, prototype, and market a product which increases required capital and is likely to discourage new startups from entering the industry. Moreover, the CE-marking is probably affecting new entrants much more than the established since incumbents are much more likely to get financing and the fact that the CE-marking cost could be dispersed on a large number of produced units. Conclusively, the

increased performance pressure will become paramount for any startup.

Sustainability aspects
Another institutional factor influencing the case company are environmental aspects which are becoming increasingly important in today's society. For example, the UN Global Compact, a network of companies and organizations, consists of ten principles, three of which are focus on the environment and how companies take active responsibility for these (United Nations, 2004). Another example is the Paris Agreement which aims to limit the increase in global temperatures to 1.5°C and was signed by almost 200 nations in 2015 (United Nations, 2015).

More ambitiously, Sweden aims to reduce emissions by at least 70% compared to 2010 by 2030 and having zero net emissions of greenhouse gases by 2045 (Ministry of the Environment and Energy, 2018). The Swedish government is working to promote increased environmental considerations (Ministry of Enterprise and Innovation, 2016), indicating that sustainable companies might achieve a competitive advantage. This is done by making clear requirements towards the business sector and well as supporting the business sector in its work on sustainability (Ministry of Enterprise and Innovation, 2017). Additionally, there are subsidies and investment support available within the electric sector (Edfeldt and Damsgaards, 2015).

The presence of sustainability factors in general and their subsequent impact on the CAS industry means that product performance in terms of reliability and efficiency becomes increasingly important. This is a result of the fact that sustainability trends and governmental pressures enhance the focus of energy efficient solutions since the systems employed today within the CAS industry are not sufficiently efficient due to the significant amount of electricity required to produce the desired amount of air (Radgen and Blaustein, 2001). Thus, the increased focus sustainability increases the performance pressure by focusing on making compressors more efficient.

Startup environment
The Swedish government is supportive of startups through its ownership in the venture capital firm Almi Invest (Almi, 2019). There are also other, non-government institutions that support startups in Sweden. One of these is Chalmers Ventures, a Swedish incubator, accelerator and venture capital firm whose incubator is ranked number one in the world (Chalmers Ventures, 2019). The case company is part of Chalmers Ventures' accelerator program and can hence benefit from the resources this provides.

Additionally, Sweden places 9th in the world in terms of competitiveness, defined as the set of institutions, policies and factors that determine productivity (Schwab, 2018). The competitiveness report is based on twelve pillars which together provides a ranking of the level of productivity for each country, with the most interesting for the case company being Business dynamism which captures the private sector's ability to create and adopt new technologies. Business dynamism is further broken down into eight factors ranging from the cost of starting a business to the growth of innovative companies and the willingness of companies to adopt disruptive ideas.

In Table A.5 in Appendix A.5 Sweden is compared to other countries in terms of Business Dynamism. The high score implies a highly competitive entrepreneurial environment. This is further supported by Bosma and Kelley (2019) where Sweden ranks 18th of 54 countries in the National Entrepreneurship Context Index with a score of 5.4 out of 10 with the highest ranking country having a score of 6.7. The favorable environment indicates that it will be easier for companies to access resources and thus focus on product performance.

In summary, institutional factors impacts key success factors, as shown in Table 4.3. Specifically, Sweden has an environment that can positively impact both performance and costs. Performance can be positively impacted by the preference the Swedish government gives to sustainable companies while costs can be decreased through the availability of subsidies and investment support. In particular, the alignment between Sweden's focus on sustainability and the case company's mission and the combination of the capital intensiveness of the business with the availability of funds makes the general environment favorable to the case company.

Table 4.3: Summary of institutional factors impact.

Institutional factor	**Impact**
Certification requirements	Increased requirements from customers means entry barriers are larger. It thus become more difficult and more important to achieve the key success factors related to product performance.
Sustainability aspects	Sustainable companies and their products have incentives to be favored by customers. Product performance is therefore likely to become more important.
Startup environment	Supportive environment means funding and subsidies are readily available. Product performance is likely to become more important since it is easier for startups to experiment and develop products with high performance.

4.1.2 Business strategy

The business strategy is an essential question as it concerns how the company are to compete in a given industry. The essentialness cannot be overlooked as the business strategy determines which firms will in the end come out on top. The business strategy as described in subsection 2.1.2 *Business strategy* is comprised of two dimensions; competitive advantage and innovation strategy. The competitive advantage allows the firm to capture a higher rate of profits persistently. How the studied firm achieves a competitive advantage will impact the operations strategy as it has to choose among several paths to create value for the customer. The innovation strategy is especially applicable in the setting of startups since it has the potential to either support or impair the potential competitive advantage and therefore by extension impact the operations strategy. The subsequent analysis will cover the

previously mentioned aspects of business strategy on an industry-wide as well as on the case company's level.

4.1.2.1 Competitive advantage

The main competitors are all large multi-national companies with substantial resources that have been in the CAS industry for a long time. Several of the main competitors compete by improving the performance of its products and protecting their innovations through the use of patents. Competitor A is the one competitor pursuing a strategy that is the most focused out of the five main competitors. The company is only targeting two out of the ten market segments, hence providing focused solutions for a narrow group of customers. However, as with the rest of the main competitors competitor B pursues a differentiating strategy focusing on providing unique and differentiated value mainly through their after-sales service as well as efficiency.

Competitor B is a clear-cut case of employing the industry-wide differentiation strategy. Furthermore, Competitor B presents five core pillars as a foundation for growth, one of these being focus on innovation which is emphasized in each of the business segments they are active in. Additionally, competitor B is generating almost half of its revenues from services (Competitor B, 2015).

As with Competitor B, Competitor C has a strong focus on innovation within a wide variety of industries. The company competes by offering high-quality, innovative products which also are competitively priced. Thus, the company to a large extent pursues a differentiation strategy with an industry-wide focus but to some degree also focuses on being competitive in their pricing thus going towards a low-cost strategy.

Competitor D serves a wide variety of industries, although not as diverse as Competitor B and C, nonetheless highly diverse. Additionally, Competitor D places great emphasis on their customer service, which is one of their four pillars for future success, indicating a strategy focusing on providing unique and differentiated value for the customer.

Competitor E emphasizes different functions to pursue a differentiation strategy. For example, to strengthen its market presence and competitiveness competitor E aims to establish a global R&D facility for new product development. Moreover, Competitor E also focuses on advanced scientific systems and process in combination with sophisticated products and technology (MarketLine, 2018*c*). However, the company also mentions that to create sustainable growth the company will pursue cost leadership within the industry by utilizing innovation (Competitor E, 2019). It is therefore the only company that has a split focus by not only offering best quality products with the help of new ICT solutions and expanding its business portfolio but also trying to achieve cost leadership (Competitor E, 2019).

In conclusion, the main competitors generally have a broad product portfolio and are active in several of the industry's market segments, as shown in Table A.6 in

Appendix A.6, as well as in several geographical markets, as shown in Table A.7 in Appendix A.6. In terms of the type of competitive advantage the main competitors are pursuing, this means that the five largest companies in the CAS industry can all be considered to pursue some sort of differentiation strategy, albeit with different levels of focus or generalization, as can be seen in Figure 4.3. The one outlier is competitor E, which is pursing more of a cost leadership strategy than the other companies.

In terms of geographical markets for the main competitors, as can be seen in Table A.7 in Appendix A.6, all of the main competitors have a global presence. However, these companies differs in what their primary market is, that is, which market constitutes the largest share of the company's revenues. Common for most of the main competitors is that Asia-Pacific, Europe or North America constitute the primary market which is in line with findings by MarketsandMarkets (2016) who found these to be the largest markets within the CAS industry.

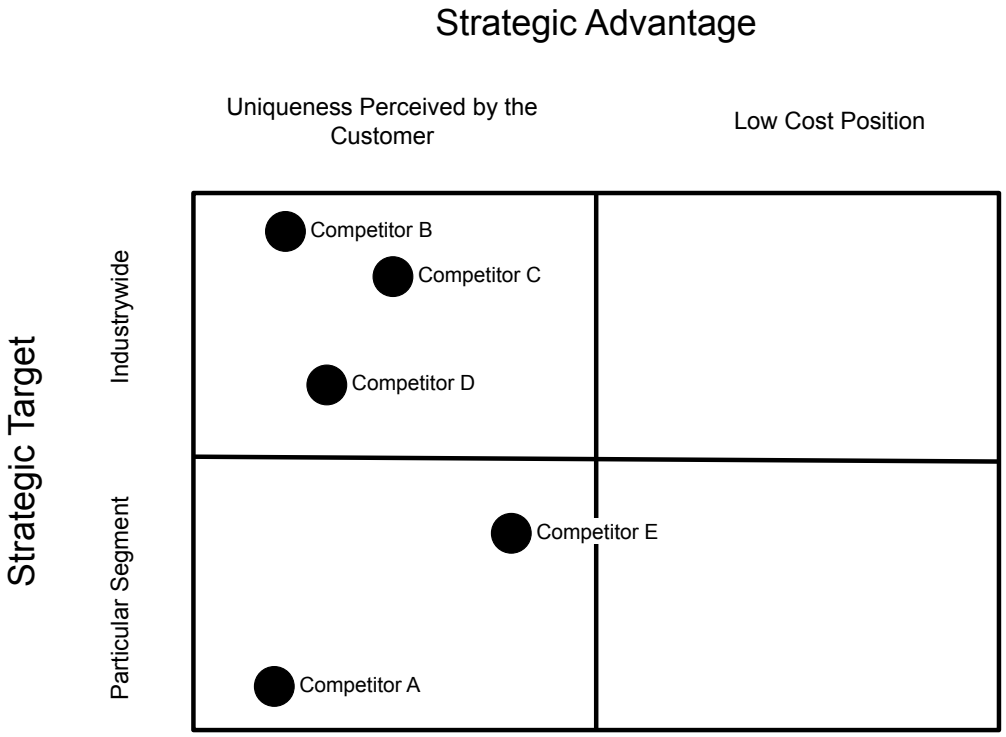


Figure 4.3: Competitive strategies pursued by main competitors.

To compete with the incumbents within the industry the case company states that their main competitive advantage is strongly linked to their technical capabilities and performance. That is, they compete by being more efficient than current offerings on the market. Furthermore, the innovative technical capabilities of the case companies innovation surpass the current offerings of the market in further aspects as well such as being able to adjust the output performance and being oil free (Case company, unstructured interview, 2019-03-25b).

As illustrated in the Figure 4.6, all of the five major competitors are pursuing some sort of differentiation strategy. It is obvious that if it would be the other way around, i.e., that the competition would have pursued a low-cost strategy within one or more segments it would put upward pressure on investment cost. However, as this is not the case it is not as clear cut as to which of the key success forces is affected the most by the differentiation strategy pursued by competitors. The goal of differentiation is to provide some unique value that is perceived by the customer to increase the value of the solution or good and by extension increase the price of the good to derive further profit. This can be done in multiple ways there is no clear cut one way to achieve superior differentiation. However, as the key success factors specified by the industry are more or less important to the customer, the individual firms are likely to focus on achieving a differentiation within the scope of these. Thus, as previously stated, customers value reliability higher than other factors, making it likely that competitors also focus on this key success factor. This is in line with the findings shown in Table A.8 in Appendix A.7.

Supporting the previously mentioned importance for the case company to focus on the performance of the product is the fact that it is also what the case company perceives as their greatest advantage. Furthermore, the case company states that their competitive advantage of superior technical performance is especially important to the CAS industry since it has the ability to significantly lower the life-cycle costs in comparison to the solutions provided by the industry today (Case company, unstructured interview, 2019-03-25b). Out of the three generic strategies for achieving a competitive advantage presented by Porter (2008*b*), focused differentiation is the most feasible for the case company. Because the high capital intensity and prevalence of entry barriers in the form of economies of scale (MarketsandMarkets, 2016) it is deemed unlikely that the case company would be able to compete on low price. Instead, the higher efficiency of the product and the subsequent potential for customers to lower their energy costs can be used as a differentiating factor. Competitive advantage thus increases the importane of key success factors related to product performance.

Further, exploring the potential competitive advantage of the case company one needs to determine whether it provides sufficiently strong barriers against competition and industry changes to be classed as sustainable in line with the definition presented by Barney (1991) in subsubsection 2.1.2.1 *Competitive advantage*. Firstly, the competitive advantage must be valuable, which the case company's product is as it aims to increase the efficiency of compressing air significantly. Moreover, by increasing the efficiency the life-cycle costs will also be reduced considerably thus providing additional value. Secondly, the competitive advantage can be classed as rare as the case company has patented the solution and therefore have proprietary rights to manufacture the apparatus. Also, as Sweden has strong property rights, as presented in Table A.11, the rarity can further be guaranteed. Thirdly, the competitive advantage is not inimitable; it is likely that competitors can and will try to replicate the case company's solution. However, for competitors to successfully do so, the imitated solution must be sufficiently different to not infringe on the patent held by the case company. Hence, the competitive advantage is to a certain

degree inimitable but not entirely. Lastly, the competitive advantage is not fully non-substitutable since there might exist another set of valuable, rare, and inimitable resources that could be implemented by another firm.

4.1.2.2 Innovation strategy

The effectiveness of patents in appropriating the value of an innovation is widely debated, as presented in subsubsection 2.1.2.2 *Innovation strategy*. However, it plays a particularly important role for the case company since the case company bases its ability to capture value from the innovation upon the patent. As the protection and enforceability of the patent protection vary from country to country, the market which the startup is active also plays a crucial role.

Park (2008) measures the strength of IP protection in 110 counties between 1960-2005 based upon an index of five indicators. The strength is then measured as the unweighted sum of a set of factors (Park, 2008). The strength of Sweden's IP protection is further supported by the Global Innovation Policy Center (2019) which ranks Sweden as the country with the third best IP protection in the world, shown in Table A.11 in Appendix A.8. As with the raking presented by Park (2008), the IP strength is based upon a set of factors which makes up the total score.

The IP strength is only one side of the coin, the other being the intensity of R&D, defined as the percentage of spending by firms on R&D each year in relation to total sales. The intensity of R&D spend does vary greatly interindustry as well as intraindustry. In relation to other industries the Capital goods industry–where the CAS industry can be considered to be includes–R&D spending is low (PwC, 2019), indicating that there are more important company activities. The intraindustry R&D spend also varies greatly, as seen in Table A.10 in Appendix A.8 with Competitor B spending 3.3% of revenues on R&D compared to Competitor D which only spends 0.9%. Additionally, the number of patents also varies greatly Table A.10.

The IP protection in Sweden is highly favorable in comparison to other countries as shown in Table A.11 meaning that the regime of appropriability is also high. The IP protection is likely to affect the operations strategy since if an industry places great emphasis on R&D it will likely increase the focus on reliability. The raised focus on reliability is due to the amount of capital needed to run an R&D department since it is not likely that a company would invest in innovation and patenting if it would not provide sufficient means to properly manufacture the innovation. As Veugelers and Cassiman, 1999, p. 76 concludes *"Strong appropriation, legally or through complexity, secrecy or lead-time on competitors, leads the firms to reduce the probability of an exclusive external knowledge sourcing strategy."* indicating that in the case of a strong IP environment the firm would place greater emphasis on controlling the process. However, if the competitive pressure increases the need to innovate and thus R&D efforts, by extension the focus on reliability increases or if the regime of appropriability in itself increases the focus on reliability is difficult to say.

4.1.3 Key success factors

Using the definition of key success factors presented in subsection 2.1.3 *Key success factors*, it becomes of interest to analyze what the main competitors of the case company consider key success factors. This data is shown in Table A.8 in Appendix A.7 and clearly shows that almost all main competitors find both reliability and efficiency important, with other aspects such as after-sales service not appearing to be of importance to some competitors. Additionally, since key success factors are company specific, it is of interest to analyze which are the more general key success factors within the CAS industry. This data is shown in Table A.9 in Appendix A.7 and shows, just like Table A.8, that reliability and efficiency are important factors. These are both related to product performance and thus have more long-term benefits.

However, since the key success factors within an industry are determined by analyzing both the customers and the competition (Grant, 2016), the key success factors for the case company are not necessarily the same as for other companies within the same industry. That customers demand solutions suited to specific applications means that one product is not likely to suit all customers. The case company with its currently limited product portfolio will therefore have to target specific market segments. Specifically, due to the higher demands on the quality of the air and the technical challenges this brings, the case company will initially focus on heavy industries with less strict air quality requirements (Case company, unstructured interview, 2019-03-25b).

Based on the findings presented in Table A.8 and Table A.9 in Appendix A.7 and on the competitive strategy stated by the case company, the key success factors for the case company as it tries to enter the CAS industry are:

1. **Reliability**: Customers wants and competitors are offering solutions that function reliably. If the system is not up and running there will be a loss of production which is very costly, thus making reliability the top criteria for CAS users (Radgen and Blaustein, 2001).

2. **Efficiency**: Efficient solutions allows the customers' to achieve lower operational costs. The operational cost is important since they stand for about 70-80% of the total life-cycle costs of a CAS (Radgen and Blaustein, 2001).

3. **Investment costs**: Customers want affordable products without too high initial costs and thus a shorter payback time. However, as the initial investment cost only accounts for around 15-20% of the total cost it is ranked lower (Radgen and Blaustein, 2001).

Using these factors, the impact of the components of competitive strategy, i.e., corporate and business strategy, on the case company's key success factors can be illustrated in Figure 4.4. Specifically, the dynamics of the industry, its institutional factors, IP-protection and the strategies pursued by the case company's main competitors are all increasing the importance of key success factors related to product

performance. Other aspects, particularly potential strategic alliances and partially industry dynamics, makes investment costs an important key success factor.

Overall, there are more factors increasing the importance of product performance. This is in line with the findings presented in Table A.8 and Table A.9 where all of the main competitors as well as several academic articles and market reports found reliability and efficiency to be the most important key success factors.

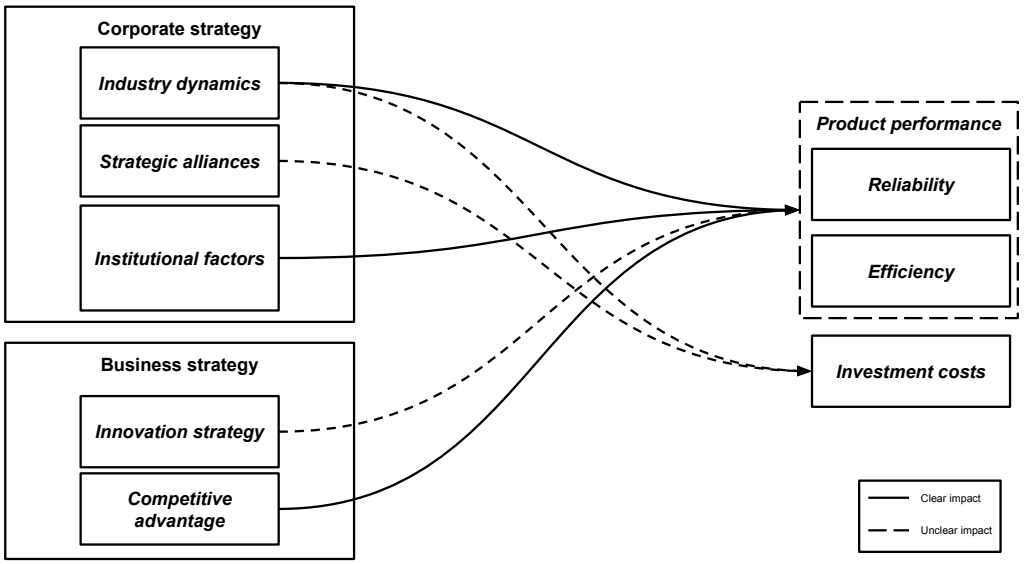


Figure 4.4: Translation of Competitive strategy to Key success factors.

4.2 Operations strategy

In determining how the operations strategy affects the business performance, it is crucial to not only consider the case company's choice of supply network design, process and service design and layout and flow in a vacuum but in relation to the industry in order to be able to adapt and change. This section will analyze each of the components of Operations strategy presented in section 2.2 *Operations strategy* as shown in Figure 4.5.

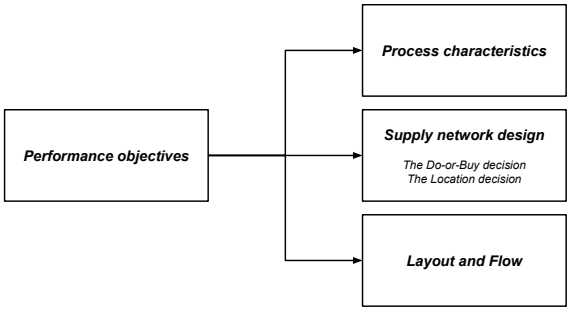


Figure 4.5: Overview of Operations strategy and its components.

In order to quantify the impact on the case company's business performance, the following analysis will use the current cost structure of the case company when it is producing its prototypes as a baseline, shown in Table 4.4, and quantify the impact on each of these cost components for each decision. By using this data as a baseline, although it might not represent what it would cost to produce a single unit in final production, it is possible to determine the relative impact the choices related to the case company's operations strategy has on its business performance. Currently, the case company is outsourcing the entirety of the production of its prototypes according to the cost structure shown in Table 4.4. As can be seen from the table, there are four main components of the case company's current cost structure, three of which the case company has been able to quantify. Specifically, manufacturing, i.e., the actual production of the prototypes, constitute the largest share of the total cost but both materials and component costs are of a sizable share.

Table 4.4: Current cost structure for the case company.

Cost	**Share**
Materials	24%
Components	29%
Manufacturing	47%
Transportation	0%
Total	**100%**

Note: Labor cost amount to 77.2% of manufacturing costs as per OECD (2009).
Source: Case company, unstructured interview, 2019-03-25a.

4.2.1 Performance objectives

The key success factors within the CAS industry presented in subsection 4.1.3 *Key success factors* can be translated to a set of performance objectives. There is a clear relationship between key success factors and performance objectives, resulting in the translation shown in Figure 4.6. Specifically, the importance of product performance in terms of reliability and efficiency means that both quality and dependability are important performance objectives and consequently makes an operations strategy with more of a focus on control increasingly attractive. Furthermore, the importance of low investment costs has a clear relationship with the performance objective of cost and hence pushes the case company towards an outsourcing/offshoring strategy where it can utilize supply-side factors such as lower labor costs.

That customers demand reliable, productive and efficient solutions (Competitor B, 2015) indicate that quality and dependability will be important performance objectives. Moreover, despite the stated importance of having solutions suited to specific applications which indicates that flexibility in terms of being able to produce several different products will be of importance, this is not applicable to the case company at this time since it is initially focusing on only a sub-segment of the total market, Thus, flexibility is not a performance objective that ought to be given priority

at this time and is therefore omitted from the following analysis. The situation would be similar regardless of the startup as it in an early phase has a too small of a market share or volume to achieve a sufficient ROI with an industry-wide differentiation strategy that flexibility requires.

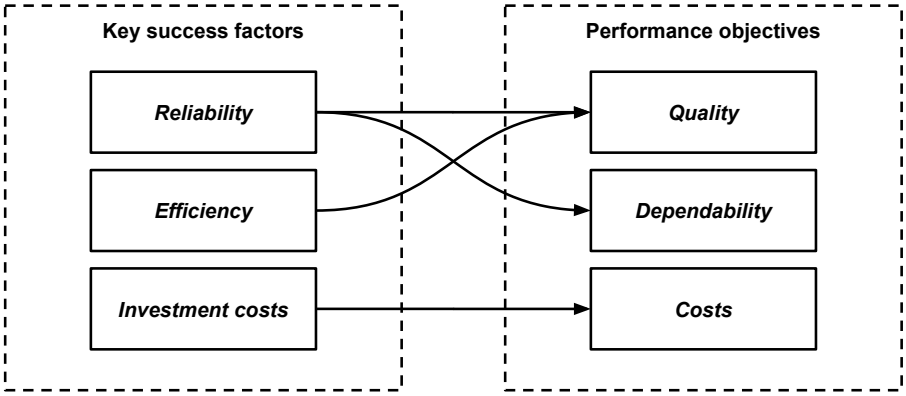


Figure 4.6: Translation of Key success factors to Performance objectives.

Additionally, the case company believes low unit costs will be an important factor in its success (Case company, unstructured interview, 2019-03-25a). This is in line with the findings of Wiman Ohlson and Montalvo Kai (2018) in that investment costs is important to customers. This conclusion can also be drawn from the fact that customers demand productive and efficient solutions (Competitor B, 2015), i.e., solutions that have low operational costs. However, investment costs constitute only a minor part of the total life-cycle cost for a CAS while energy costs account for the majority of the life-cycle costs (Radgen and Blaustein, 2001). This indicates that efficiency is likely to be more important to customers than investment costs, supported by Radgen and Blaustein (2001) who found that price is the least important performance criterion for customers and that rather quality and reliability are the most important criteria.

Out of the quality dimensions presented by Bergman and Klefsjö (2010), performance, reliability, environmental impact and safety are the ones most applicable to the case company since these are related to the customer requirements presented by both Competitor B (2015) and Wiman Ohlson and Montalvo Kai (2018). For the case company and the CAS industry, performance and environmental impact refers to efficiency, i.e., how much energy the customer can get from the product, reliability refers to up-time and safety refers to the safety of workers manufacturing the product.

The impact of performance objectives on a company's operations strategy has been well-documented and can be illustrated as in Figure 4.7. Generally speaking, performance objectives related to producing a better product from a performance perspective tend to draw a company's towards an operations strategy and more specifically a supply network design with more focus on control, while performance objectives related to costs obviously tends to make control an aspect companies are willing to give up in order to achieve lower costs.

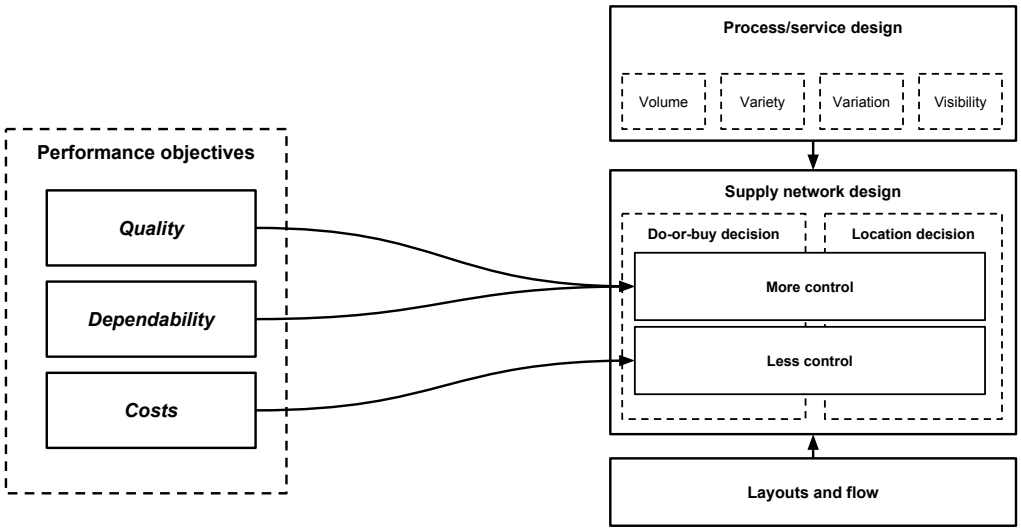


Figure 4.7: Performance objectives impact on operations strategy.

Moreover, process characteristics and layouts and flow influence the decisions related to a company's supply network design. Specifically, process characteristics such as variety makes control more or less important since this influences the complexity of production and thus influence how far away, both organizationally and geographically, a company might be willing to place its operations. Finally, layouts and flow, itself being dependent on process characteristics, influence the do-or-buy decision where layouts and flows suited for standardized products might require investments in specialized machinery, thus resulting in a more expensive decision to perform ones operations in-house.

For the case company, the performance objectives of quality and dependability makes a supply network design with more control more attractive, while the performance of objective of costs makes a supply network design where the case company would be able to utilize supply-side factors, at the potential expense of less control, more attractive. Furthermore, the relatively low variety and low volume means that outsourcing might be more feasible since it would be relatively simple for a third party to produce the company's products. Moreover, the low volume and variety means that the layout and flow suitable to the case company's operations would be either a cell or a functional layout as presented in Figure 2.9. This entails that if the case company were to perform its operations entirely in-house, the investments related to the factory would be significant since specialized machinery would presumably be required to properly manufacture the products.

4.2.2 Supply network design

The design of the supply network consists of, as described in subsection 2.2.2 *Supply network design*, the do-or-buy and the location decision. The subsequent analysis will analyze the decisions made by the case company's main competitors as well as what factors influence the suitability of each of these decisions.

When analyzing the supply network design, the do-or-buy decision can be analyzed according to transaction cost theory presented by Williamson (1975) and the location decision can be analyzed using the location parameters presented by Abele et al. (2008). In choosing between the locations, Sweden emerges as an obvious option since it is the home country of the case company. In choosing other potential countries, the *Global Services Location Index* by A.T. Kearney (2014) ranks countries according to three criteria; *Financial attractiveness*, *People skills and availability*, and *Business environment*. The top three countries on this index are India, China and Malaysia (A.T. Kearney, 2014). In order to account for the location parameters of distance to relevant markets and transportation costs, Poland and Bulgaria, two European countries that ranked highly on the list, were also included.

4.2.2.1 Do-or-buy decision

When facing the do-or-buy decision, the case company has the choice of either performing the entirety of its operations in-house, outsourcing the production to a third party, or something in between. Performing its operations in-house would include building a factory and hiring personnel in order to produce its product and would obviously require large amounts of capital. Table A.13 shows the building costs of a factory in the countries presented above.

The three attributes that give rise to transaction complexity presented by Williamson (1979) determines the size of a company's transaction costs and can thus be used as a measure of whether or not the case company ought to perform its operations in-house or outsource them. In the case of the case company, both asset specificity and uncertainty can be deemed to be relatively low since, as will be covered in subsection 4.2.3 *Process design*, the case company's products are of low variety and relatively low complexity. Moreover, since the case company is currently a startup it has not yet achieved sales enough to generate demand for high volumes. The frequency of its transactions with other actors can therefore be considered low. Taken together, this means that the case company is expected to face relatively low transaction costs.

On the other hand, if the case company were to outsource its operations it would be able to reap the benefits presented in subsubsection 2.2.2.1 *The do-or-buy decision*. However, Dvořáček (2010) found that there are hidden costs associated with outsourcing which can account for up to 52% of the total outsourcing costs. Table A.14 in Appendix A.9 shows the estimates presented by Dvořáček (2010) of the hidden costs of outsourcing. However, not all of the hidden costs presented in Table A.14 applies to the case company. Specifically, since the case company currently does not have any activities to transfer or business processes that require changing it can avoid those costs. The total hidden costs of outsourcing can therefore be estimated to be between 10% and 40%. However, not all of these hidden costs are likely to apply to the case company and the total hidden costs can therefore be assumed to be 25% which is the average of the range presented by Dvořáček (2010). Outsourcing can not only bring positive effects but also negatively impact business performance

by increasing costs through hidden costs.

Moreover, as production grows the case company has the potential to reduce unit costs through both learning curves and economies of scale. There have been several studies attempting to quantify the impact of both of these concepts and two rough generalizations are *the experience curve* (Henderson, 1968) and the *0.6 rule* (Moore, 1959). *The experience curve* says that each time accumulated experience is doubled, costs decrease by 20-30% (Henderson, 1968) while the *0.6 rule* says that the relationship between volume increase (V) and equipment cost (C) is $\frac{C_1}{C_2} = (\frac{V_1}{V_2})^{\alpha}$ where $\alpha = 0.6$ (Moore, 1959, Tribe and Alpine, 1986). Consequently, for every doubling of volume ($V_2 = 2 \cdot V_1$), equipment costs increases only by approximately 52%, thus decreasing unit costs by little over one third. In terms of the impact of automation, in a study of factory automation in Sweden, Carlsson (2012) found that labor costs did not decrease as much as expected but that the automation reduced costs in terms of inventory and operating expenses. Conclusively, learning effects and economies of scale can positively impact business performance by lowering unit costs.

One the other hand, if the case company were to conduct its operations entirely in-house, it would need to account for the fact that building costs vary significantly between the selected countries, shown in Table A.13 in Appendix A.9. Setting up a basic factory or warehouse in China is almost one-third of the startup costs in Sweden. The difference is equally striking among the European countries with Sweden being almost twice the cost of Poland in setting up a basic factory and almost three times the cost setting up a high-tech factory or laboratory. Thus, the choice between countries of where to locate a factory depends on the type. If the case company are to set up a high-tech factory with a complex layout and flow India would be the prime choice, while if the case company would decide to set up just a basic factory China would be the best choice. However, the choice is not this simple and additional location factors will thus be assessed in the subsequent section.

In terms of sourcing, the ready availability of raw materials and use of standardized components means that from a sourcing perspective, the products are not difficult to manufacture. Additionally, since none of the components used in the product are particularly large or bulky they are likely easy to ship which means that logistics costs should be low. All of this means that the case company can utilize global sourcing as presented by Abele et al. (2008) in order to achieve the most favorable offer by lowering costs, thus improving business performance. Based on data presented in subsubsection 4.2.2.1 *Do-or-buy decision*, the estimated cost impact of utilizing global sourcing can be shown in Table A.19 in Appendix A.10.

On the qualitative side of the do-or-buy decision for the case company, there is a desire to keep control of management and technical development (Case company, unstructured interview, 2019-03-25a). This is similar to the case company's main competitor whose manufacturing strategy is to manufacture critical components in-house (Competitor B, 2018), presumably in order to maintain control over the production. The size of this competitor further supports this notion, as the competitor is likely to have both the requisite skills and the ability to utilize economies of scale

when producing in large quantities. However, the case company is initially open to outsource significant parts of its operations and are not looking to invest in manufacturing capabilities in the foreseeable future (Case company, unstructured interview, 2019-03-25b). Moreover, the case company asserts that the apparatus is relatively simple to manufacture and is therefore well suited in its design to outsource. However, as the case company is early in the phase of manufacturing their innovation, it is essential to access manufacturing partners who can provide feedback into the design process (Case company, unstructured interview, 2019-03-25b).

4.2.2.2 Location decision

In terms of the location-decision, there are two types of data that are of importance to this thesis; what decisions the main competitors have made and which locations might be attractive to the case company. The two questions will provide a guideline of what choices the industry incumbents have made in the past an how those choices have influenced their business performance as well as what choices lie ahead of the case company and therefore will impact the future business performance of the case company.

Competitors operations

As shown in Table A.7 in Appendix A.6, all of the main competitors of the case company has a large geographical presence in terms of active markets. This is also the case for the main competitors operations, with all competitors having several dozen manufacturing plants in a multitude of countries and continents as shown in Table 4.5. The fact that all of the main competitors have operations in Asia-Pacific, Europe and and North America makes sense since these are also the largest markets in the CAS industry (MarketsandMarkets, 2016). That the main competitors are global companies means that when a competitor is locating its operations outside its home country, it might be doing so not only because of the supply-side factors of that location but also because of its demand-side factors as described in subsection 2.2.2 *Supply network design*. For the case company, which is currently working to acquire customers and is initially focusing primarily on the Swedish market, this means that there are mostly supply-side factors that would be appealing with a potential offshoring decision. Offshoring its operations could thus result in improved business performance by accessing the supply-side factors of lower labor and sourcing costs. Table A.20 in Appendix A.10 shows the estimated impact on business performance of outsourcing the case company's operations to a set of different countries.

Table 4.5: Regions main competitors have operations in.

Country	A	B	C	D	E
Asia-Pacific	✓	✓	✓	✓	✓
Europe	✓	✓	✓	✓	✓
Middle East and Africa	✓		✓	✓	
North America	✓	✓	✓	✓	✓
South America			✓	✓	
Oceania	✓				

Source: Main competitors annual reports.

Assessing potential locations

When assessing potential locations, one can use the location parameters presented by Abele et al. (2008), namely; labor cost, cost of capital, cost of materials, labor productivity, capital productivity, distance from relevant markets and logistical and business indices.

Labor cost

Labor cost plays a important role in deciding where to locate (Abele et al., 2008). However, comparing the average hourly wage of each country or region as pointed out by Abele et al. (2008) is too simplistic which means that it is also essential to compare the hourly wage by skill level, which could vary widely. This wide gap is illustrated by the fact that the difference in hourly wages in China between a semi-skilled worker and a plant manager is approximately 2,200% (Abele et al., 2008). However, as the case company is more inclined to outsource rather than set up its own production (Case company, unstructured interview, 2019-03-25b), the average hourly wage is most interesting. Since outsourcing assumes a lack of control in terms of human capital the average cost is more likely a better estimate.

As presented in Table 4.6, it is clear that all other countries assessed has a clear cost advantage compared to Sweden. Since the case company with today's manufacturing method is dependent on labor, this is an important factor. Furthermore, the cost advantage becomes even more evident when looking at the mean nominal monthly earnings of employees in different economic activities as presented in Table A.15 in Appendix A.9 where there is a stark difference between Sweden and the other countries. Consequently, the country with the lowest labor costs, focusing on manufacturing, is Malaysia followed by Bulgaria.

Table 4.6: Hourly wage cost for each of the assessed countries.

Country	Hourly wage cost [USD/h]
India	1.42
Malaysia	4.03
Bulgaria	4.28
China	5.30
Poland	11.26
Sweden*	43.52

Note: *Sweden's hourly labor cost is converted from EUR to USD using the conversion rate of 1.1353 (Bloomberg, 2019). Furthermore, the labor cost for Sweden represents the total hourly labor cost, without other labor costs included the labor cost would be 34.92 USD.

Source: Eurostat (2019*b*), Global-production Inc. (2018).

Cost of Capital

The cost of any firm is an important subject as it determines the overall rate that any investment must overcome in order to be profitable. Hence, if there is a difference between countries in cost of capital it might follow that some investments are better suited for some countries, as with the example of establishing a factory. Moreover, as noted by Fernandez (2007) the general formula for the cost of capital is:

$$WACC = r_E(1 - L) + r_D(1 - T_c)L$$

where $L = \frac{D}{V}$*,* $D =$ *debt value,* $V =$ *total value of equity and debt,* $T_c =$ *applicable specific tax,* $r_E =$ *rate of equity, and* $r_D =$ *debt rate.*

Following, by definition, is the effect of each independent countries' return on equity, cost of debt–rate of debt, general lending rate–, and corporate tax within the country. However, since the differences between the cost of capital of each country are so small, as seen in Figure A.6 in Appendix A.9, it is not likely to notably affect the investment decision. Nevertheless, if the countries' political, institutional, legal, or banking (to name a few) changes the situation might change. Between the years of 2014 and early 2019 the cost of capital has remained relatively stable as can be seen in Figure A.6 in Appendix A.9. The individual countries relative ranking has as the cost of capital remained unchanged with the exception of Malaysia who traded places with Poland in 2017. Further, the countries with the highest cost of capital are India and Bulgaria.

Cost of Materials

According to Abele et al. (2008), materials generally account for 50 to 80% of the cost of the product being manufactured. In line with this, the case company claims to have a substantial part of its total cost that is derived from the cost of material (Case company, unstructured interview, 2019-03-25a), making it a crucial factor in the location decision. Figure A.7a in Appendix A.9 shows the economic pricing outlook for steel–one of the main components of the case company as well as the CAS industry (Dun&bradstreet, 2018)–in the U.S., Europe, and China in descending order according to price. It is notable that the price of steel is expected to decline in every region over the coming years slightly. This stale decline is further supported by the global price of iron ore and aluminum displayed in Figure A.7b in Appendix A.9, where the two commodities before 2004 were relatively stable especially iron ore. Furthermore, looking at the trend from 2012 til 2016 shows a steep decline in the price it is just recently both of the commodities saw a slight increase.

The price advantage that the Asian countries hold is here further increased since it is clear that the prices of material in the region is less than in Europe. However, it seems that looking forwardly to 2020 the price difference is somewhat eroding, as the difference in price between Europe and China is expected to decrease by almost half by 2020 in comparison to 2017.

Labor Productivity
As illustrated in Figure A.10 in Appendix A.9 the labor productivity, defined as the ratio between outputs generated by the supplied inputs with the input being labor (OECD, 2001), varies greatly between the assessed countries. Thus, the above-mentioned cost advantage of Asian countries is somewhat deteriorated as the output per worker since 2000 is not even half of the output per worker in Sweden. Taking a wider stance it is clear that the general forward-looking is slow but positive since every country on the list is expected to improve their labor productivity by 2023. However, China is expected to grow much more rapidly than the rest and has from 2000 until 2018 showed clear signs of achieving this.

Alternatively to labor productivity, *Total factor productivity* or *Multifactor productivity* is defined by Comin, 2006, p. 1 as *"the portion of output not explained by the amount of inputs used in production."* As such, it is a measurement of how well and efficiently inputs are used in the production (Comin, 2006). Differences in total factor productivity can be due to how the physical prevalence of technology, utilization of technology, management practices, organizational change, general knowledge, network effects, economies of scale, and spillover from production factors to mention a few (OECD, 2018*b*, Comin, 2006). Hence, the total factor productivity is important in the overall measurement of productivity. The total factor productivity from 2000 until 2014 is presented in Figure A.9 in Appendix A.9. As with the labor productivity Sweden comes out on top, although Poland has seen a significant improvement and are closing in on Sweden. Bulgaria is the country which has decreased the most during the 14 year period. Moreover, both India and China has seen a slight increase in total factor productivity but is still under half of Sweden's total factor productivity.

Capital Productivity
As with labor productivity, capital productivity is defined as the amount of output produced by a defined amount of inputs. In this case, capital productivity is defined as the Capital Stock divided by Output-side real GDP, according to the OECD (2001), which is presented in Figure A.8 in Appendix A.9. Firstly, it is clear from the figure that during the period 2000 to 2014 Malaysia has suffered the most in loss of capital productivity. Secondly, over the covered period there is only one country that has increased its capital productivity, namely Poland. Thirdly, the remaining countries have during the period seen a slight decrease in capital productivity and are clustered around 0.3-0.4.

Capital productivity will not likely affect the investment decision for the case company as it has converged over the years. If there would be a clear difference in capital productivity between the countries it would mean that produced output could be achieved with less capital. However, as the differences between the assessed countries are relatively minor, this is not a factor influencing the location decision significantly.

Distance from relevant markets
As pointed out by Abele et al. (2008), there are several factors that influence the long-term transportation costs of sea freight transportation; e.g., the global trade trends, the ship capacity with a focus on supply and demand, and production cost

trends (larger ships or lower cost of ships due to increased automation etc.).

Table 4.7 shows the shipping distance and cost from Sweden, Gothenburg to each country. In terms of lead time, Poland has the advantage since the it takes approximately 2 days for a container to reach Sweden 16 days for Bulgaria. However, since none of the data presented in subsection 4.1.3 *Key success factors* indicate that lead time is of primary importance to customers, this is not the factor that should be given the greatest weight. In terms of costs, no rates were available for Poland and Bulgaria which makes it difficult to compare these two countries in terms of that factor. Out of the other three countries, India is clearly the most expensive while Malaysia and China are relatively similar in terms of cost.

Table 4.7: Shipping distances to each country.

Country	Nautical Miles	Days	Cost
Poland	522	2.18	N/A
Bulgaria	3,802	15.84	N/A
India	6,850	28.54	$1,040
Malaysia	9,718	40.49	$796
China	11,564	48.18	$823

Note: Days is calculated using the speed of 10 knots.
Source: Veson Nautical Distance (2019) and Xeneta.

Logistical and Business Indices
In terms of the qualitative factors for the location decision as suggested by Abele et al. (2008), for each country, three important factors will be presented and covered in more detail in the following section. These are shown in Table 4.8 and are; *Ease of doing business*, *Enabling Trade Index* and *Trade Logistics Index*.

Table 4.8: Summary of rankings for Logistical and Business Indices.

Country	Ease of doing business	Enabling Trade Index	Trade Logistics Index
Sweden	12	5	2
China	15	31	26
Poland	33	37	28
Malaysia	46	53	41
India	59	61	44
Bulgaria	77	102	52

Firstly, the *Ease of Doing Business Index* shows that Sweden ranks highest among the evaluated countries with an overall rank of 12. However, Malaysia also ranks high in the index with an overall rank of 15. The rankings indicate that with regard to the formation and operation of a business enterprise Sweden is the country that facilitates these process the most and provides a rigorous regulatory environment

as support. Notable is the strong ranking of Malaysia in regards to dealing with construction permits, registering property, and protecting minority investors. Also, Poland ranks best in the world when it comes to trading across borders an important factor in outsourcing. Finally, China is the country on the list providing the most rigors enforcement of contracts.

Secondly, even though the *Enabling Trade Index* shares some of the parameters with the *Ease of Doing Business Index* it paints another story as seen in Table A.16 in Appendix A.9. Sweden, again, places first in the overall ranking but with a much greater margin. This is due to Sweden's strong rankings in other categories such as Efficiency and transparency of border administration, Availability and quality of transport services, and Availability and use of ICTs.

Thirdly, the *Trade Logistics Index* presented in Table A.18 in Appendix A.9 makes it evident that Sweden has the best conditions for connecting its domestic market with foreign markets and vice verse. Even though Sweden is by far the highest ranking country in the *Trade Logistics Index* the other countries have lower inter-country variability of ranking. For example, China and Poland are only two places apart. The same can be said for Malaysia and India which is only three places apart.

Summary

To conclude, the impact of the supply network design decisions on the case company's business performance is summarized in Table 4.9. As can be seen in the table and as previously shown in Figure 4.7, all of the supply network design decisions for the case company impacts the cost component of business performance.

Table 4.9: Summary of the impact of supply network decisions on business performance.

Supply network design decision	**Category**	**Business performance impact**
Do-or-buy decision	Outsourcing	Costs
	Global sourcing	Costs
Location decision	Offshoring	Costs

Furthermore, just as with the *Do-or-buy decision*, the importance of quality and dependability as performance objectives means that the case company is inclined to keep its operations on-shore since this provides it with the ability to exercise greater control. This means that, on the extremes of the location decision, i.e., choosing either on-shoring/in-house or offshoring/outsource, the performance objectives of quality and dependability requires greater control and thus favors an on-shoring/in-house decision. Similarly, the performance objective of costs favors offshoring/outsourcing since supply-side factors can allow the case company to utilize both cheaper labor costs as well as economies of scale in order to lower production costs.

Additionally, the fact that labor costs are assumed to constitute 77.2% of total manufacturing costs (OECD, 2009) combined with the increasing automation of

manufacturing indicates that labor costs could be lowered further by investing in specialized machinery, something the case company believes will be possible (Case company, unstructured interview, 2019-03-25a). Furthermore, as presented in subsubsection 4.2.2.1 *Do-or-buy decision*, as the case company expands its operations and volume grows, learning effects and economies of scale will mean that labor costs and consequently manufacturing costs will be a less significant factor–shown in Figure A.11 in Appendix A.11–while transport costs will remain the same, resulting in a decrease of potential savings from offshoring. Thus, the savings in unit costs for the countries whose main advantage is low labor costs will decrease as volume grows–shown in Figure A.12 in Appendix A.11.

However, the impact on business performance is not the only thing that should be of importance to the case company. Table 4.10 shows the relative ranking of each of the location parameters covered in this section. The data shows that, contrary to the data presented in Table A.20, Sweden is the most attractive country for the case company to locate its operations when including more qualitative parameters such as the logistical and business indices.

Table 4.10: Relative ranking of location parameters.

Location parameter	**SWE**	**IND**	**CHN**	**MYS**	**POL**	**BGR**
Labor costs	6	1	4	2	5	3
Cost of capital	1	5	2	4	3	6
Cost of materials	2	1	1	1	2	2
Labor productivity	1	6	5	3	2	4
Capital productivity	6	4	5	3	1	2
Distance from relevant markets	1	4	6	5	2	3
Ease of doing business	1	6	4	2	3	5
Enabling Trade Index	1	6	5	3	2	4
Trade Logistics Index	1	5	2	4	3	6
Total score	**2.22**	**4.22**	**3.78**	**3.00**	**2.56**	**3.89**

Note: Total score is calculated as the average of all location parameters with 1 being the highest score and 6 the lowest.

4.2.3 Process design

In terms of the process characteristics, the case company is at the outset exhibiting low volumes due to the fact that it is still in the customer acquisition stage, low variety due to the fact that it only has one product and low visibility towards potential customers. Variation in demand, however, is high since CAS customers are subject to cyclical demand which means that demand might decrease during e.g., economic downturns as well as exogenous factors such as oil prices impacts the attractiveness of substitutes (Dun&bradstreet, 2018). Figure 4.8 shows where the case company ends up when applying the process characteristics to the typology of operations presented by Slack et al. (2007).

Since the main competitors of the case company are targeting the same customers

as the case company, it has basically the same process characteristics as the case company, especially in terms of variation in demand and visibility. However, the size of the competitors means that the volume of products they are producing is higher than for the case company. Additionally, the competitors that are active in several of the industries have different offerings are hence a higher variation compared to the case company that is currently only focusing on a sub-set of the total market.

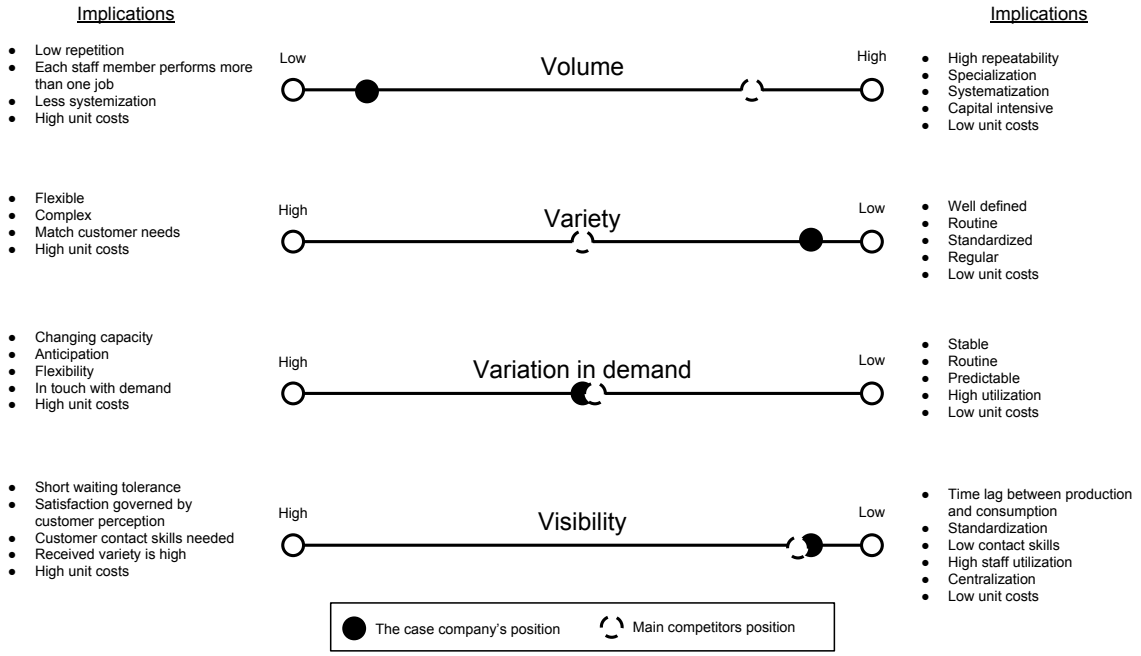


Figure 4.8: Typology of operations applied to the case company

The process characteristics of the case company's main competitors presented in Figure 4.8 help explain why there are significant entry barriers to the CAS industry as these companies are likely to be able to achieve economies of scale and thus lower unit-costs. However, they also indicate that there likely are opportunities for investment in specialized equipment, thus reducing unit costs but raising entry barriers. Specifically for the case company, the opportunities for standardization coming from the low variety and variation are made less feasible because of the low volume. Furthermore, the opportunities for standardization means that the option to performs its operations entirely in-house becomes less feasible due to the larger initial investment required. However, as the case company's volume grows, it will be moving towards a position where achieving low unit-costs is more feasible.

In terms of the impact on business performance, the relative low complexity of the case company's products means that outsourcing will likely be feasible but the structure of the product means that more complex manufacturing entailing e.g. automation might prove challenging. However, the low volume and low variety favors outsourcing since the case company would be unable to utilize economies of scale on its own. In terms of these factors, the process characteristics can indirectly influence the case company's ability to lower costs through supply-side factors.

Additionally, the low variety of the case company's product portfolio as a result of its focused strategy in terms of market segments means that the company is limiting its revenue potential. An increased variety and thus a broader product portfolio would allow the case company to sell to more potential customers and thereby increase its revenues. For the case company, which is initially targeting all markets segments but Food & Beverage within Europe, this means that it is currently missing out on 9.9% of the available market (MarketsandMarkets, 2016) and could thus increase potential revenues with approximately 11% by expanding its product portfolio and covering this market.

4.2.4 Layouts and flow

Although it is difficult to find data on the type and layouts and flow used by the case company's main competitors, based on the analysis presented in Figure 4.8 and the relationship between process types and layouts described by Slack et al. (2007) and shown in Figure 2.9, it is reasonable to assume that the main competitors are using either a batch or mass process accompanied by either a functional or cell layout. This means that the main competitors probably have had incentives to invest in specialized equipment, indicating that the initial investments required if the case company were to perform the entirety of its operations in-house by building a factory would be substantial.

The fact that the case company's main competitors presumably have invested in specialized equipment in order to lower costs has certain implications. Firstly, there is likely to be a potential to specialize ones production and achieve economies of scale and learning effects in order to lower unit costs. Secondly, although specialized equipment would have the potential to reduce variable costs it is likely to increase the initial investment needed to perform ones operations in-house, thus influencing the do-or-buy decision towards outsourcing where the initial investment needed to start production is lower. However, the potentially lower unit costs as a result of economies of scale and learning effects are likely only achievable at larger volumes since that is when the cost of the specialized equipment can be spread over more units. In conclusion, if the case company were to build a high-tech factory rather than a standard factory in order to utilize economies of scale and automation, the building costs per m^2 would be 286% higher.

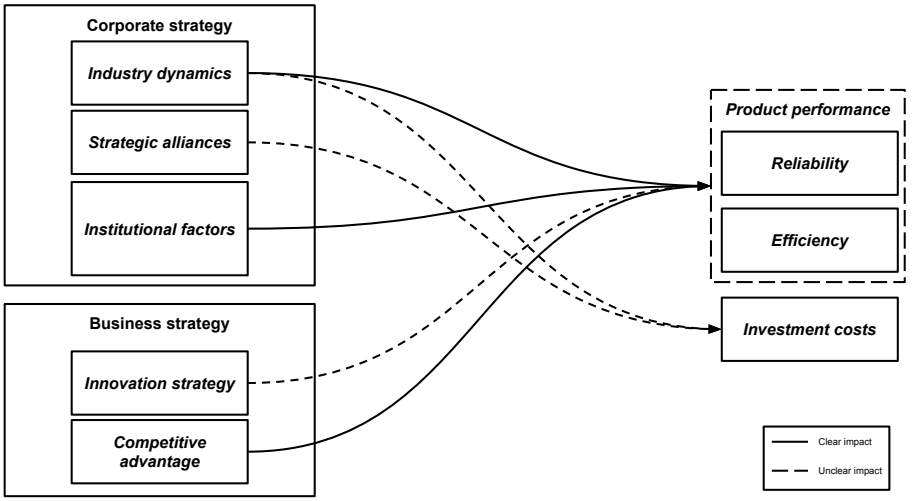
4.3 Answering the research questions

The first research question, *RQ1*, regarded competitive strategy's impact on operations strategy. More specifically, it sought to answer the more specific question of how each of the components of a startup's competitive strategy affected its operations strategy.

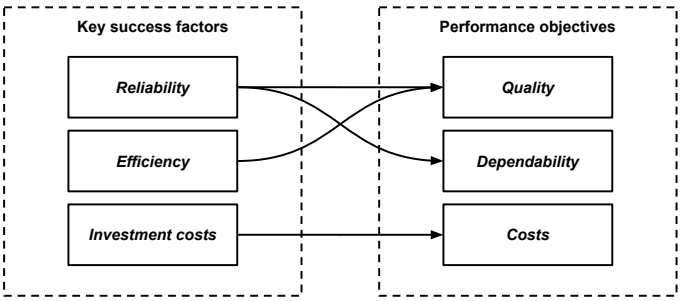
RQ 1: *How does a startup's competitive strategy affect its operations strategy?*

RQ1 can be answered as: **A startup's competitive strategy affects its operations strategy by influencing a set of key success factors that can be translated into performance objectives. Competitive strategy therefore limits the options available when choosing its operations strategy. A startup must therefore align its competitive strategy with its operations strategy.**

The influence of the different components of competitive strategy on a set of key success factors is shown in Figure 4.9a. Furthermore, these key success factors can then be translated into a set of performance objectives according to Figure 4.9b. In the case studied in this thesis, the competitive strategy being pursued by the case company in combination with the customer requirements of the CAS industry has resulted in a set of key success factors that consequently makes quality and dependability important performance objectives. The case company is therefore limited to options with regards to its operations strategy that result in the maintaining of control in order to ensure the fulfillment of these performance objectives.



(a) Translation of Competitive strategy to Key success factors.



(b) Translation of Key success factors to Performance objectives.

Figure 4.9: Translation of Competitive strategy to Performance objectives.

Specifically for the case company and its competitive strategy, the CAS industry is defined by moderate intensity in terms of industry dynamics. There are two of the forces that affect the overall industry intensity more so than others. Firstly, the threat of rivalry between competitors as it is a complex industry with competition both on a regional level as well as globally. Secondly, the threat of new entrants increases the industry intensity due to the considerable amount of capital needed in order to break into the CAS industry. Additionally, within the CAS industry, there is widespread adoption of utilizing strategic alliances for several purposes. Notable for the CAS industry, but also applicable for the broader sector of machinery, is the apparent influence of institutional factors such as the CE-marking and sustainability trends which will have a direct impact on the case company. Furthermore, within the CAS industry, the focus lies on following a differentiating strategy as a competitor are generally active in several segments as well as geographies and have wide product portfolios. The competitive landscape is also defined by low to moderate R&D intensity leading to a decreased focus on innovation strategy.

The second research question, *RQ2*, regarded the impact of a startup's operations strategy on its business performance. Business performance was defined in terms of revenues as costs and, just as with *RQ1*, the impact of each of the components of operations strategy was analyzed.

RQ 2: *What is the impact of a startup's operations strategy on its business performance?*

RQ2 can be answered as: **A set of performance objectives, in combination with process design and layouts and flow, influences the suitability of the choices in terms of a startups supply network design. The decisions made with regards to the startups supply network design and process design subsequently impact its business performance by determining whether the company is able to achieve increased revenues or decreased costs.**

Figure 4.10 illustrates both how the performance objectives, process design and layouts and flow influences operations strategy as well as how each of the components of operations strategy impact business performance. In the case studied in this thesis, the decisions related to the design of the supply network impact the cost side of the startups business performance, while the process design has the potential to positively impact the revenue side.

Specifically for the case company and its operations strategy, there are three performance objectives, quality, dependability and costs, that are of main importance as the case company tries to achieve its key success factors. Two of these factors, quality and dependability, influence the case company's supply network design decision towards one with more focus on control, i.e., on-shoring and/or in-house production, while the final performance objective, costs, makes control less important and thus offshoring and outsourcing more attractive options.

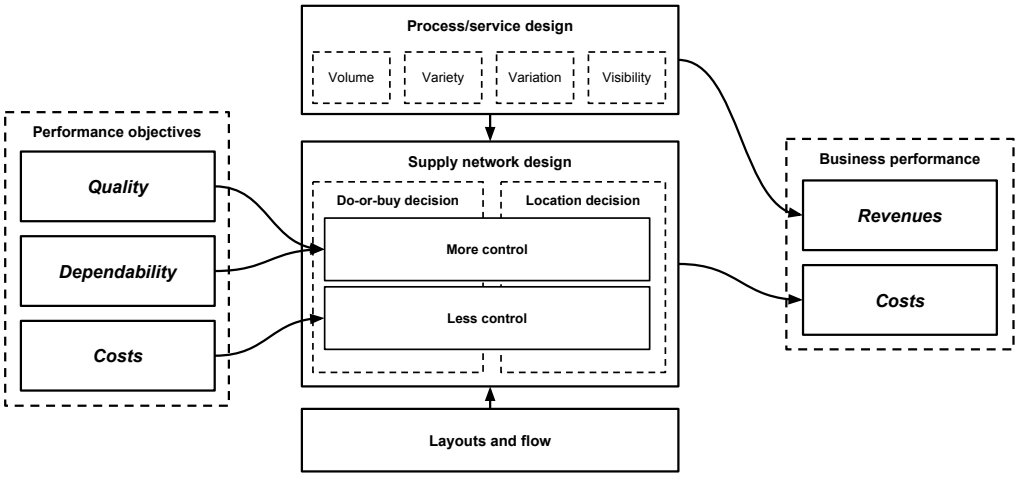


Figure 4.10: Operations strategy's impact on business performance.

Additionally, there several location parameters, both quantitative and qualitative, influencing the location decision which together indicate the suitability for a set of locations. Furthermore, the process characteristics shows a difference between the case company and its main competitors which helps explain how the case company's production might differ from its main competitors. Additionally, the process characteristics means that the process design and layouts and flow can be set up in order to achieve economies of scale and subsequently low unit costs. However, this is likely to result in high initial investments, thus making a decision to keep the production in-house more expensive at the outset.

In terms of the specific impact of each of the components shown in Figure 4.10, Table 4.11 shows the estimated impact on business performance for a set of different scenarios. As can be seen from the table, the scenario with the greatest single impact on business performance is offshoring.

Table 4.11: Summary of different scenario's estimated impact on business performance.

Scenario	Decision area	Revenue/ Cost impact	Business performance impact
Offshoring w/ local sourcing	Supply network design	Cost	0-41%
Global sourcing	Supply network design	Cost	0-6%
Outsourcing	Supply network design	Cost	-12-+38%
Increase variety	Process design	Revenue	11%

Note: Revenue/cost impact is defined as the increase/decrease on each factor, respectively. Increase variety refers to the expansion of the product portfolio.

Combining Figure 4.9a and Figure 4.10 results in the complete conceptual model shown in Figure 4.11. This model contains all the components of the conceptual model presented in Figure 2.10 in chapter 2 but applied to the case company.

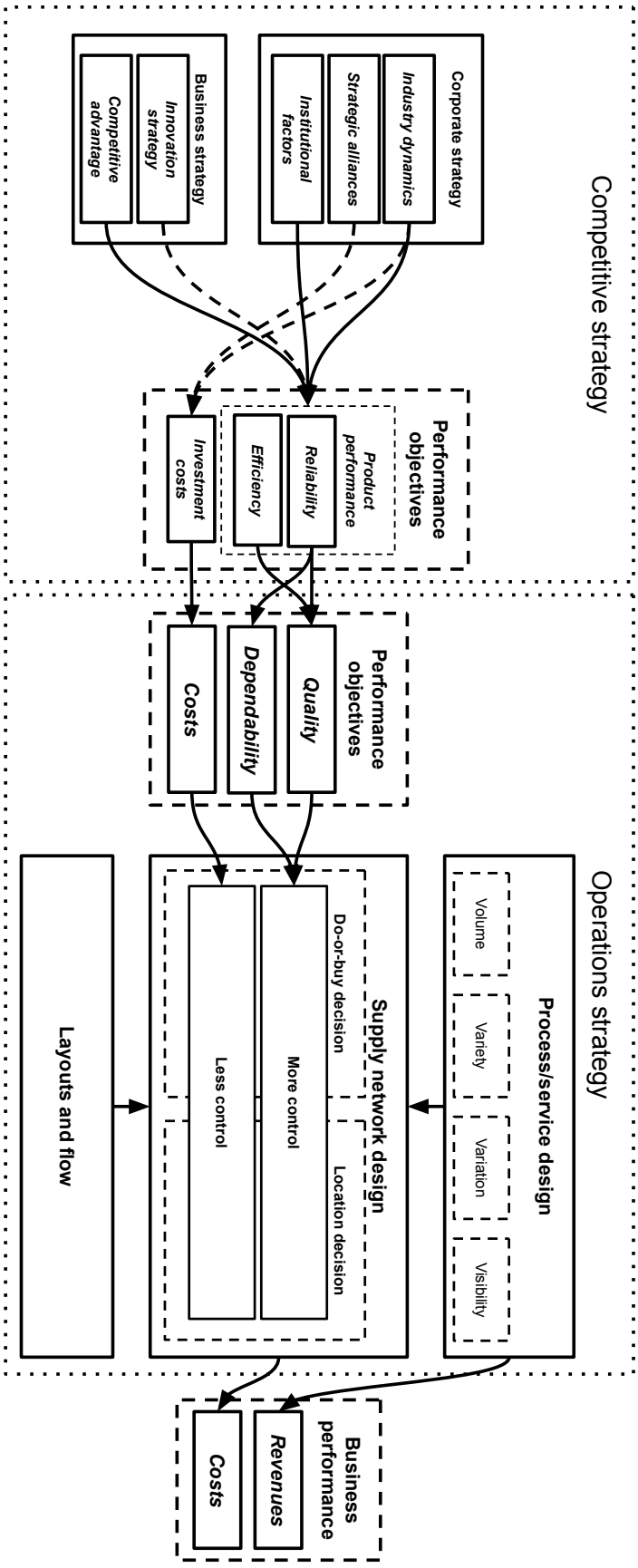


Figure 4.11: Complete conceptual model.

5

Discussion

The following chapter will discuss the analysis presented in the chapter 4. The chapter is structured looser than chapter 2 and 4 in order to allow for a more fluent discussion. The discussion will use relevant literature in order to help explain why certain results were achieved as well as how this compares to other authors' findings.

5.1 Competitive strategy

As illustrated in Figure 4.11 the industry dynamics are assessed to have a clear influence over the operations strategy with help from the mediating effect of the key success factors. This topic has previously been studied by several scholars which are exemplified below. The moderate intensity of the CAS industry enforces the key success factor of reliability, thus increasing the importance of the performance objectives of quality and dependability. The strong focus on reliability, quality, and dependability is mainly due to the moderate to high level of threat of competitive rivalry. Badri et al. (2000) supports the notion that competitive rivalry increases the focus on reliability, quality, and dependability. More specifically, Badri et al. (2000) asserts that competitive hostility within the industry increases the emphasis on quality and delivery for high performing firms. The delivery factor is defined by Stonebraker and Leong, 1994, p. 45-46 *"the dependability in meeting requested and promised delivery schedules, or speed in responding to customer orders"*, which corresponds to the performance objective of dependability. Moreover, Badri et al. (2000) also asserts that the dynamism in the market also increase the emphasis the quality and delivery, where dynamism in the market constitutes the rate of innovation and rate of product replacement. Also, Sum et al. (1995) affirmed, prior to Badri et al. (2000), the increased focus on quality and delivery performance as a consequence of business dynamism and competitive hostility within high performing firms.

Finally, the above-mentioned relationship has also proven to hold true for emerging economies where the environmental variables play a significant role in the choice of operations strategy (Amoako-Gyampah and Boye, 2001). Consequently, the case company will need to ensure that their products maintain high quality in terms of reliability in addition to its already high efficiency. Ergo, the case company, are as previously asserted, likely affected by the industry dynamics and must adapt

accordingly by prioritizing key success factors in order to successfully develop an operations strategy.

As the industry is currently in a mature phase with a stable growth the industry intensity is not likely to change. Nonetheless, if the competitive forces where to change towards becoming more intense, i.e., the competition within the landscape where to increase, the case company would need to set up blocking mechanisms in order to shield them from the increased competition, thus making survival more likely. Additionally, as the industry growth starts to decline price increasingly becomes an order winner (Slack et al., 2007), thus making it likely that the key success factors shift towards more of a focus on investment costs. The case company therefore need to dynamically adjust and align its competitive strategy with its operations strategy. The relationships illustrated in Figure 4.11 therefore need to be continuously evaluated as they are not static and their impact may vary over time.

In terms of strategic alliances, the case is not as clear as with industry dynamics as depicted in Figure 4.11 *Complete conceptual model.*. By definition, strategic alliances do not imply how a specific goal should be achieved but only that it should be achieved. This might be a reason or the unclear relationship between a strategic alliance and key success factors. Furthermore, as mentioned in subsubsection 2.1.1.2 strategic alliances can take several forms and therefore also present a factor for uncertainty. Moreover, the intent and motives of entering a strategic alliance do vary greatly. As can be seen in Figure 4.11 and as previously mentioned, the case company is currently primarily interested in accessing knowledge related to production, thus resulting in strategic alliances' impact on investment costs.

Additionally, the choice of strategic alliance impacts the firm's flexibility and control (Todeva and Knoke, 2005). More specifically a firm might hope to increase their flexibility by accessing new skills, knowledge, and markets (Todeva and Knoke, 2005, Chan et al., 1997, Rothaermel and Boeker, 2008, García-Canal et al., 2002). Strategic alliances ability to affect the key success factors of reliability, efficiency and investment costs is supported by the strong correlation between partnership quality and outsourcing success found by Lee (2001). Furthermore, Hung et al. (2015) showed that a firm utilizing strategic alliances can improve their cost competitive position as well as firm performance. However, a strategic alliance also comes with an increased interdependence of other partners and therefore lessens the control. Therefore, the use of strategies alliances may either support or deteriorate the key success factors of the industry. The case company will therefore have to weigh the advantages of accessing resources it will need to scale with the increased interdependence and loss of control that strategic alliances can result in.

As presented in Table 4.3 and seen in Figure 4.11 the institutional factor presents a clear relationship between the cause and effect on the subsequent key success factor. A specific example in terms of certification requirements for the manufacturing industry within the EEA (European Economic Area) is the need to conform to the CE directives which encompass health, safety, and environmental protection requirements. If these are not met the manufacturing company will be either

restricted or rejected by the member countries. Additionally, if the manufacturer is not compliant with the regulations, they could be fined a significant amount of money (Lin et al., 2005). Hence, it is a clear example of how the failure of aligning the business strategy with the institutional factors will lead to worse performance than that of the competitors. Several scholars (e.g., Sun (2000), Anderson et al. (1999), Withers and Ebrahimpour (2000)) have shown various positive impacts of obtaining an ISO 9000 certification on business performance. Firstly, Withers and Ebrahimpour (2000) found that the quality of the business is positively influenced by possessing an ISO 9000 certification. Moreover, each of the studied firms achieved their competitive advantage based upon some subset of the quality dimensions. Secondly, Sun (2000) provides evidence of a significant difference in business performance between firms possessing an ISO 9000 certification and those who do not. Thirdly, Anderson et al. (1999) presents the notion that an ISO 9000 certification is obtained as part of a larger strategy in order to gain a competitive advantage.

In terms of sustainability aspects, although there have been several studies on the relationship between sustainability, or more generally, corporate social performance (CSP), and corporate financial performance (CFP), no clear consensus has been reached (Brammer and Millington, 2008). In the cases of a positive relationship between these two concepts, this is because of the contribution of CSP to either reduce costs or increase revenues, for example by reducing regulatory and governmental costs or by promoting the company's product (Navarro, 1988).

Thus, the previously asserted relationship between institutional factors as well as the key success factors for the case company will undoubtedly be important. Institutional factors such as ISO 9000 might positively influence quality and dependability which in turn have been shown to positively influence business performance. Furthermore, the sustainability factor may differ from country to country as it is highly dependent on both trends as well as the general political climate and may therefore act in different ways. Nevertheless, the institutional factors are the factors which has the clearest direct impact on a startup as it contrary to other factors can force a company to comply with certain regulations. Thus, institutional factors has the most direct impact on the case company. Also, the other assessed factors become harder to determine in terms of effect as they affect companies indirectly.

Nevertheless, the institutional factors are the factor which has the clearest direct impact on a startup as it can force a company to comply which is not the case with any other factor. Thus, it is the one asserting the most direct impact on the company. Also, the other assessed factors are harder to determine in terms of effect as they affect companies indirectly. Moreover, if the case company were to enter new market segments with higher requirements on e.g. air quality, it is possible that it would face new, more strict certification requirements, thus making the key success factors related to product performance more important. It is also possible that new key success factors would emerge both from customer requirements and social trends.

The competitive advantage as shown in 4.11 indicates a clear relationship to the key success factors. The increased focus on reliability and consequently quality and

dependability is an outcome of the competitive landscape described in section 4.1 *Competitive strategy*. This is supported by findings of Ward and Duray (2000), Ward (1996), and Williams et al. (1995) who concludes that business strategy and operations strategy are intertwined. More importantly, Ward and Duray (2000) states that a differentiation strategy for high performing firms only works when accompanied with a focus on quality. Findings, from Amoako-Gyampah and Acquaah (2008) also indicate a strong relationship between the business strategy, both differentiation and cost leadership, and operations strategy.

Furthermore, Amoako-Gyampah and Acquaah (2008) concludes that a firm focusing on cost leadership should focus on low-cost manufacturing which increases the importance of investment cost and subsequently the performance objective of costs. However, Amoako-Gyampah and Acquaah (2008) also asserts that a firm focusing on a differentiation strategy should focus on quality and flexibility. Amoako-Gyampah and Acquaah (2008) exemplifies this by affirming that a company can increase its differentiating prowess by getting ISO 9000 certified, thus also supporting the previous discussion on institutional aspects and impact. Lastly, Amoako-Gyampah and Acquaah (2008) found a strong relationship between the performance objective of quality, both when pursuing business pursuing a cost leadership strategy and a differentiation strategy, and business performance. Hence, in order to compete with the incumbents the case company must place great emphasis on quality as this is the norm of the competitive landscape. However, if the competitive landscape would change towards a greater focus on low-cost and cutting prices the case company would have to align its business strategy with the new landscape in line with previous discussion about the industry dynamics.

Considering the innovation strategy as the final factor of the Competitive strategy, seen in 4.11, the relationship is somewhat unclear. However, as concluded by Allred and Park, 2007, p. 106 *"[...] even after controlling for firm, industry, and other national factors there is a very strong positive relationship between the level of a country's patent rights and changes in patent rights on firm innovation investment."* indicating the impact of IP strength on product performance. Hence, the IP strength on a country basis is important to consider before the operations strategy. For example, if the IP strength of where the firm operates is low it may not be possible to focus on the performance objectives of quality and dependability. Notwithstanding, this relationship needs to be further studied to assert the causal relationship.

5.2 Operations strategy

The impact of performance objectives shown in Figure 4.11 and the results presented in section 4.2 *Operations strategy* are in line with findings by Shavarini et al. (2013) who found that suitable operations strategies centered around quality or dependability were, among others, vertical integration strategy and large facility size strategy, both of which are inclined towards more control. Additionally, Shavarini et al. (2013) also found that suitable operations strategies centered around cost were non vertical integration strategy and automation based strategy, both of which entails less control.

For the case company, this means that from a purely qualitative view operations strategies inclined towards in-house production and on-shoring are likely to be most suitable.

In terms of the do-or-buy decision, as presented previously there is the potential for significant savings through economies of scale and learning effects. However, this stipulates that the case company is performing its operations in-house which requires significant resources in order to get the full effect. Additionally, in order for the case company to achieve the desired effects it is necessary that is has the correct knowledge in terms of operations within the company which is not the case at the moment. Using the decision logic presented by Slack et al. (2007) in Figure 2.6, it is clear that the case company ought to explore outsourcing its operations since it neither has specialized knowledge nor superior operations performance. In addition to the high initial investments required performing the operations in-house also has other disadvantages, e.g., in terms of additional risk, less flexibility and the possibility that the case company loses focus on its core.

Moreover, as shown in Figure 4.11, there is a potential for offshoring and global sourcing measured to positively influence the case company's business performance by reducing costs. Specifically for global sourcing, the results presented in subsubsection 4.2.2.1 *Do-or-buy decision* are in line with findings by several authors (e.g., Trent and Monczka (2003), Monczka and Giunipero (2017), Nassimbeni (2006)) who found the potential of lower costs to be the most important rationale for global sourcing. However, the fact that the estimated savings presented in Table A.19 are relatively minor is supported by the findings of Holweg et al. (2011) who found no evidence that low-wage country sourcing led to cost reductions compared to industrialized countries. Vos et al. (2016) proposes three basic cost elements of global sourcing; static, dynamic and hidden costs. It is therefore possible that these costs are the reason for the failure of firms to achieve potential savings. Additionally, the case company need to consider the factors brought up by Slack et al. (2007) for global sourcing, specifically indirect costs such inventory carrying costs, cross-border taxes, tariffs and supply and operations risk.

In terms of offshoring, the findings presented by Mckinsey Global Institute (2003) indicate a possible saving of 58% when offshoring in contrast to the assessed offshoring impact with a maximum impact of 41% as seen in Table A.20. There exists several explanations of the notable difference in estimated savings e.g., the baseline data may be distorted. Nevertheless, the takeaway is that there exists a clear savings potential when offshoring not the specific amount. Additionally, the suitability of these decisions are likely to change over time for two primary reasons, thus making the choice more difficult. Firstly, as presented in section 4.2 *Operations strategy* and Appendix A.11, the cost structure changes with increasing volumes and thus mans changes the suitability of certain countries as potential offshoring locations. Secondly, offshoring and outsourcing decisions are not static over time as argued by Mudambi and Venzin (2010). For the case company, this could mean that countries whose primary advantage is low labor costs will become less attractive as these countries becomes richer and wages increases. Furthermore, following from the

previous discussion on competitive advantage and the possibility of a shift towards an increased focus on cost this would also most likely impact the operations strategy. An increased focus on cost would raise the attractiveness of offshoring since it has the highest potential for cost savings.

Thus, the importance of certain performance objectives limits the case company in terms of the choices it has with regard to its supply network design. Although the results presented in chapter 4 indicate a clear potential for cost savings, primarily through offshoring, the importance of aligning its operations strategy with its competitive strategy and consequently a set of performance objectives makes this less feasible. However, as discussed in the previous paragraphs, the key success factors might change as industry growth declines and it is therefore important to continuously evaluate the performance objectives that are of most importance and align its operations strategy accordingly.

Moreover, as seen in Figure 4.11, increasing variety and thus broadening the case company's product portfolio has the potential to positively impact business performance by increasing revenues. However, it is worth noting that although an increase in product variety would positively impact revenues which means that this increase would, contrary to cost decreases, not correspond to an equal increase in business performance. Furthermore, the increase in product variety brings a trade-off between increased revenues and increased costs as a result of the loss of economies of scale (McDuffie et al., 1996). This is in line with findings by several authors (e.g., Moran (1996), Leschke (1995)) who have found that an increase in product variety can negatively impact productivity and profitability. Again it becomes important for the case company to consider the performance objectives that are of importance and to make sure that it aligns its operations strategy with these, e.g., by initially reducing variety in order to ensure high quality on the products it sells.

As shown in Figure 4.11, layouts and flow has been analyzed mainly through its impact on the case company's supply network design, particularly the do-or-buy decision. Particularly, the suitability of particular layouts and flows affects in initial investment cost needed to build a factory and therefore also negatively influences the feasibility of the case company performing its operations in-house. However, if the case company were to decide to perform its operations in-house, it is reasonable to assume that the changing from one layout to another will impact performance. This is supported by Gunasekaran et al. (2000) who found that a redesign of a plant's layout could reduce non-value adding activities, even for SMEs. Additionally, in their review of comparative performance studies, Agarwal and Sarkis (1998) found that both cell and functional layouts can lead to significant operational benefits.

Assuming the case company were to perform its operations in-house, it would also need to face the decision of whether to lean above or below the diagonal in the product-process matrix shown in Figure 2.8 in chapter 2. Hayes and Wheelwright (1979*a*) argued that a position below the diagonal can lead to a significant competitive advantage as long as there is no major change in design or volume. For the case company this would correspond to an increased focus on costs at the expense of

less flexibility. However, as investment cost is not the most important key success factor this might not apply to the case company. Furthermore, the case company would also need to consider the costs related to changing its layout and processes and the impact this would have on business performance. These costs would likely include both the direct costs of changing the layout and flow but also the indirect costs related to e.g., loss of productivity and employee training.

6

Conclusion

The following chapter will conclude this thesis by presenting a recommendation to the case company based on the analysis and discussion presented in chapter 4 and chapter 5. Specifically, the suitability and feasibility of the choices the case company has with regards to its operations strategy will be covered. Finally, the chapter will conclude by discussing the implications of the results and point out potential areas for future research.

With the research questions answered in chapter 5 and the aim of the thesis fulfilled, a recommendation can be presented to the case company for how to best proceed as it tries to scale its production and take its innovation to market. The analysis and discussion presented in the previous chapters shows that outsourcing might not be particularly attractive but that it is the most feasible options and that there is the potential for large savings by locating the production in another country where the case company would be able to utilize supply-side factors. However, the analysis also showed that quality and dependability are two important performance objectives, thus, contrary to the potential savings from low-cost manufacturing, making control over the production more important and offshoring less attractive. Moreover, as shown in Figure A.12 in Appendix A.11, the savings the case company are able to achieve by offshoring are decreasing with increasing volume.

Since savings that can be made by offshoring are not insignificant, especially not at lower volumes, the decision of whether or not offshoring is a good idea becomes more difficult. On the one hand, as a startup with limited resources the case company are obviously interested in every potential saving it can achieve while on the other hand, these savings are largest at low volumes at which point an argument can be made that control in order to ensure the quality and dependability of the products is most important as this is where the case company builds a reputation. Additionally, the potential savings, independent of volume, needs to be weighed against other qualitative factors such as the Business and Logistical Indices presented in subsubsection 4.2.2.2 *Location decision*. All of these indices painted the same picture, i.e., Sweden is clearly favorable in terms of these qualitative aspects. Although it is difficult to quantify the value of these, the fact that savings decrease as volume grows combined with the importance of control results in a recommendation to the case company to keep its production in Sweden.

The decision of whether or not to outsource is also influenced by both positives and negatives, thus making it difficult. Firstly, the hidden costs related to outsourcing means that it is likely to be more expensive than performing the operation in-house. Secondly, as volume grows so does transaction costs, thus making outsourcing less attractive as the case company scales. However, performing the operation in-house might be infeasible at this time since the product characteristics mean that in order to achieve the best effect of in-house production the case company needs to invest in specialized machinery and equipment which requires significant resources, both in terms of money and knowledge, that the case company does not have at this point in time. Moreover, just as with offshoring, raw material and component costs per unit are likely to decrease with increased volume thus reducing the attractiveness of global sourcing as volume grows. Finally, performing the operation would also bring additional risks and might result in a loss of focus on other parts of the business. The case company are therefore recommended to outsource its production.

The recommendation presented above has certain implications for the case company but also for startups in general. Firstly, the impact of competitive strategy on operations strategy be of many sorts. It would be interesting to see future studies attempting to quantify the impact of competitive strategy, both on operations strategy but also on business performance as well as the reverse, i.e., how operations strategy impact competitive strategy.

Secondly, in terms of operations strategy and its impact on business performance, the difficulties startups face with regards to the do-or-buy decision are particularly interesting. Almost by definition startups have few resources and therefore do not have many alternatives other than outsourcing its operations. This means that it is especially difficult for startups to achieve costs that are comparable to larger incumbents, thus indicating that a cost-leadership strategy might be infeasible for startups. It would be of interest to see future research explore how startups can avoid this trade-off.

Thirdly, since the supply network design decision or more specifically the location decision had the greatest potential impact on business strategy, it would be interesting to see future research perform more thorough estimations of potential savings, both in terms of other potential countries but also for other industries and types of companies to be able to compare these differences. Moreover, it is likely that the cost of raw materials will decrease per unit as volume increases. Future research could attempt to quantify this in order to determine the impact of global sourcing as a function of volume.

Finally, the area of layouts and flow was in this thesis largely treated as an input influencing the do-or-buy decision. Future research could investigate the impact of this component further by attempting to quantify its impact on both business performance but also on the cost of performing ones operations in-house. Additionally, it would be interesting to see future research attempting to determine the importance of layouts and flow in achieving economies of scale and learning effects.

A

Appendix

A.1 Innovation protection

Table A.1: The effectiveness of appropriability regime mechanisms in different industries.

Industry	Number of Firms	Secrecy	Patents	OtherLegal	Lead Time	ComplementarySales/Svc	Complementary Mfg.
Food	89	58.54	18.26	21.18	53.37	39.83	51.18
Textiles	23	63.70	20.00	25.87	58.26	55.22	58.26
Paper	31	55.00	36.94	26.45	47.10	40.00	39.84
Printing/Publishing	12	32.50	12.08	21.67	48.33	66.25	60.42
Petroleum	15	62.00	33.33	6.33	48.67	40.33	35.67
Chemicals, nee	65	52.77	37.46	21.62	48.62	44.92	41.31
Basic Chemicals	35	48.00	38.86	11.57	38.29	45.86	44.71
Plastic Resins	27	55.93	32.96	18.15	38.33	44.63	46.11
Drugs	49	53.57	50.20	20.82	50.10	33.37	49.39
Miscellaneous Chemicals	29	70.69	39.66	25.52	55.52	55.17	48.97
Rubber/Plastic	35	56.86	32.71	10.14	40.86	34.29	37.71
Mineral Products	18	46.11	21.11	12.22	39.72	37.78	40.00
Glass	6	46.67	30.83	11.67	50.00	62.50	70.00
Concrete, Cement, Lime	10	45.00	30.00	17.50	38.00	45.50	40.00
Metal, nee	6	65.83	20.00	5.00	50.83	58.33	61.67
Steel	10	37.00	22.00	11.50	61.50	34.50	42.00
Metal Products	44	43.07	39.43	18.18	48.18	37.05	40.11
General Purpose Machinery, nee	74	49.19	38.78	20.88	52.23	41.15	43.65
Special Purpose Machinery, nee	64	45.08	48.83	23.05	59.69	46.33	51.09
Machine Tools	10	61.50	36.00	9.00	61.00	43.00	34.50
Computers	25	44.20	41.00	27.20	61.40	40.20	38.00
Electrical Equipment	22	39.09	34.55	15.00	33.41	32.27	31.82
Motor/Generator	22	50.91	25.23	19.09	48.86	47.27	45.23
Electronic Components	26	34.04	21.35	20.19	45.58	50.00	51.15
Semiconductors and Related Equipment	18	60.00	26.67	22.50	53.33	42.22	47.50
Communications Equipment	34	47.21	25.74	20.15	65.59	42.06	41.18
TV/Radio	8	50.00	38.75	35.63	53.75	24.38	38.75
Medical Equipment	67	50.97	54.70	29.03	58.06	52.31	49.25
Precision Instruments	35	47.29	25.86	20.86	54.14	49.57	45.57
Search/Navigational Equipment	38	48.95	28.68	24.08	46.84	32.89	40.53
Car/Truck	9	42.22	38.89	19.44	65.56	41.67	42.22
Autoparts	30	50.83	44.35	15.65	64.35	44.84	53.06
Aerospace	48	55.10	32.92	16.15	58.02	34.58	46.88
Other Manufacturing	84	49.29	33.81	26.61	63.51	42.56	45.30
ALL	1118	51.00	34.83	20.71	52.76	42.74	45.61
	(s.e.)	(0.96)	(0.94)	(0.73)	(0.92)	(0.91)	(0.88)

Note: The above percentages shows the ratio of companies reporting that the specific mechanisms was effective in protecting their innovations.
Source: Cohen et al. (2000).

A.2 Estimation of Sweden market size

Table A.2: GDP and population of countries in "Rest of Europe".

Country	**Population (M)**	**Population (%)**	**GDP (B)**	**GDP (%)**
Spain	46.57	25.45%	1 311	23.29%
Italy	60.69	33.16%	1 935	34.37%
Sweden	**9.995**	**5.46%**	**538**	**9.56%**
Netherlands	17.08	9.33%	826	14.68%
Poland	37.97	20.75%	525	9.32%
Slovakia	5.44	2.97%	96	1.70%
Norway	5.26	2.87%	399	7.08%
Total	**183**	**100%**	**5 629**	**100%**

Table A.3: Estimation of Sweden's CAS-market size.

	By population	**By GDP**	**Equal share**
"Rest of Europe" size ($ M)	1023.8	1023.8	1023.8
Share of "Rest of Europe"	5.46%	9.56%	14.29%
Sweden size ($ M)	55.9	97.8	146.3
Sweden share of Europe total	**0.92%**	**1.61%**	**2.41%**

A.3 Estimation of the CAS industry growth

Table A.4: Growth estimation for the CAS industry.

Growth Estimation: Revenue	**2014**	**2015**	**2016**	**2017**	**2018**	
Competitor A	3 349 598	3 992 110	4 046 810	3 914 018	4 110 816	
Competitor B	93 721	98 973	101 356	85 653	95 363	
Competitor C	12 891,4	13 301,1	13 509,3	14 198	15 668,2	
Competitor D	2 570	2 127,2	1 939,4	2 375,4	2 690,2	
Competitor E	7 736	7 688	5 964	5 729	6 567	
	830,2	558,3	894,2	550,2	897,2	
Growth Estimation: Percent	**2014**	**2015**	**2016**	**2017**	**2018**	**Average Growth**
Competitor A	N/A	19,18%	1,37%	3,28%	5,03%	5,57%
Competitor B	N/A	5,60%	2,41%	15,49%	11,34%	0,96%
Competitor C	N/A	3,18%	1,57%	5,10%	10,35%	5,05%
Competitor D	N/A	17,23%	8,83%	22,48%	13,25%	2,42%
Competitor E	N/A	0,62%	22,42%	3,95%	14,63%	3,09%
Average Industry Growth						**2,18%**

Note: The individual currencies of each competitor are not disclosed due to the sensitivity of the numbers and because of the irrelevance when calculating growth.
Source: MarketLine (2018*b*, 2019*b*,*a*, 2018*a*,*c*)

A.4 Supporting details on analysis of Porter's five forces

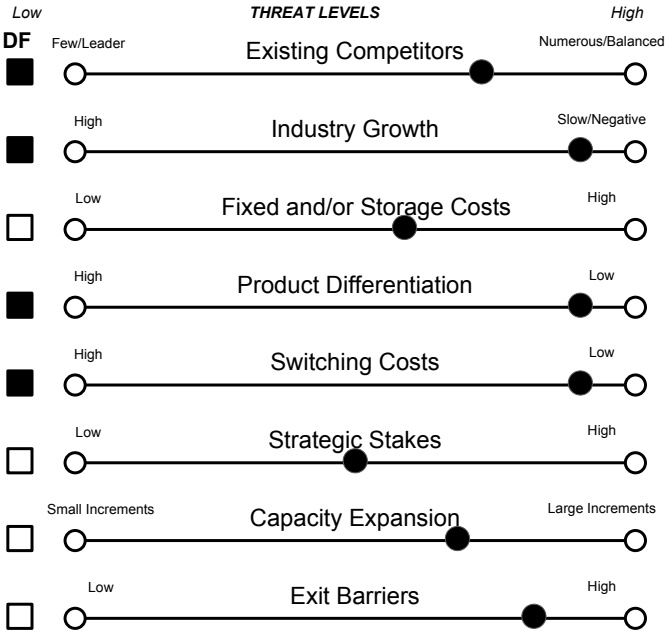


Figure A.1: Underlying factors of the threat of competitive rivalry.

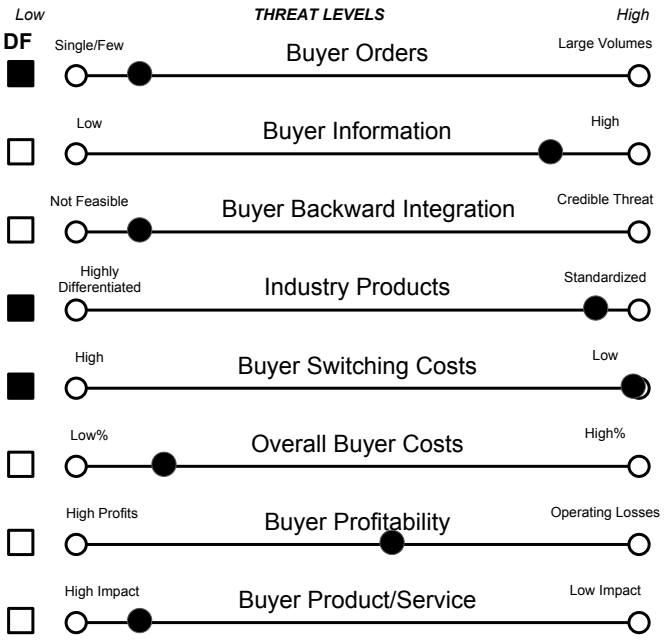


Figure A.2: Underlying factors of threat of buyers.

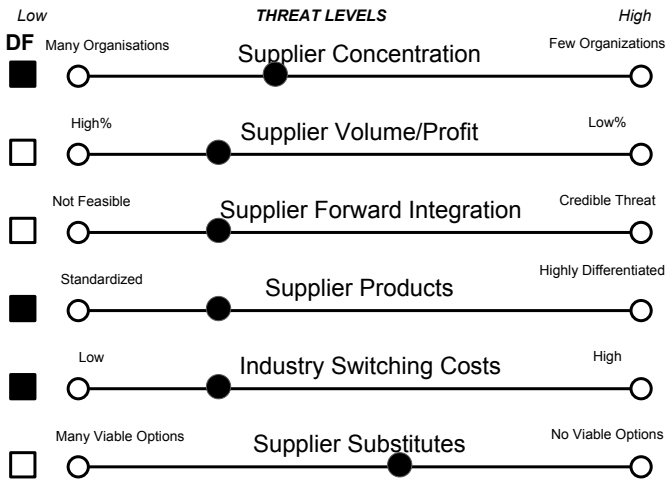


Figure A.3: Underlying factors of threat of suppliers.

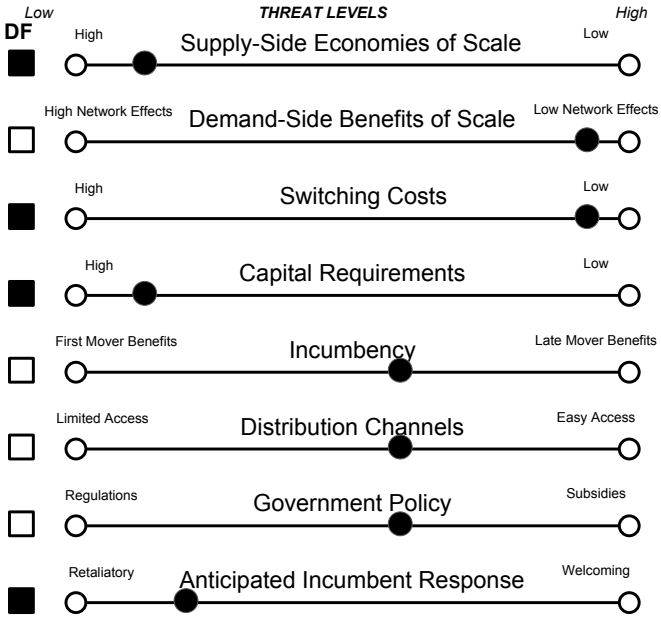


Figure A.4: Underlying factors of threat of new entrants.

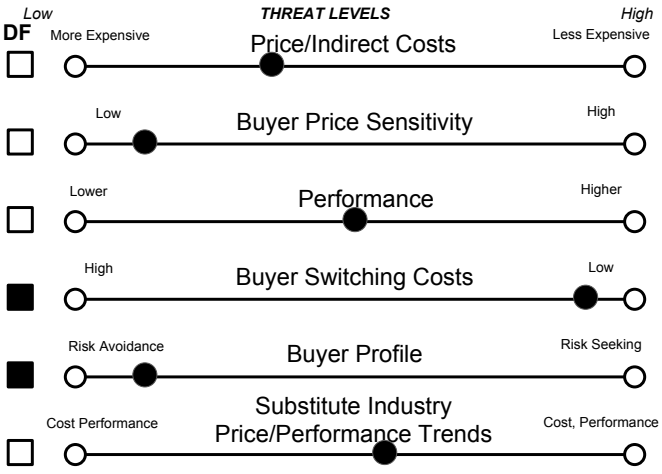


Figure A.5: Underlying factors of threat of substitute.

A.5 Business dynamism

Table A.5: Business dynamism of selected countries.

	Sweden	**U.S.**	**U.K**	**Germany**	**France**
Cost of starting a business, %GNI per capita	99.8	99.5	100	99.1	99.7
Time to start a business, days	93.5	94.9	96	89.9	97
Insolvency recovery rate, cents/$	84.1	88.4	91.7	86.8	79.1
Insolvency regulatory framework	75	93.8	68.8	93.8	68.8
Attitudes toward entrepreneurial risk	66	79.4	68.5	67.5	46.2
Willingness to delegate authority	83.8	78.4	75.3	76.3	63.2
Growth of innovative companies	74.1	80.1	69.4	72.9	54.7
Companies embracing disruptive ideas	62.5	77.5	62.1	66.5	46.7
Overall Score	**79.8**	**86.5**	**79**	**81.6**	**69.4**

Source: Schwab (2018).

A.6 Competitor data of industry segments and regions

Table A.6: Industries competitors are active in.

Industry	A	B	C	D	E
Manufacturing		■	■	■	
Power generation		■	■	■	■
Chemical & petrochemicals	■	■	■	■	
Oil & gas	■	■	■	■	■
Food & beverage		■	■	■	
Metals & mining		■	■	■	■
Rubber & plastics		■			
Pulp & paper		■			
Water & wastewater treatment		■			■
Pharmaceuticals		■	■	■	

■ Company active in industry

Source: MarketsandMarkets (2016) and competitor annual reports.

Table A.7: Regions competitors are active in.

Region	A	B	C	D	E
Asia-Pacific	■	■	▒	▒	■
Europe	▒	■	▒	■	▒
Middle East and Africa	▒	▒	▒	▒	▒
North America	▒	▒	■	■	▒
South America	▒	▒	▒	▒	
Oceania	▒				■

■ Primary market
▒ Active market

Source: MarketsandMarkets (2016) and competitor annual reports.

A.7 Key success factors

Table A.8: Key success factors for each of the main competitors.

Key success factor	Competitor A	Competitor B	Competitor C	Competitor D	Competitor E
Reliability		✓	✓	✓	✓
Efficiency	✓	✓	✓		✓
Investment cost			✓		
Application-specific solutions		✓		✓	
After-sales service	✓	✓		✓	

Source: Company annual reports.

Table A.9: Key success factors according to academic articles and market reports.

Key success factor	Marketsand-Markets (2016)	Dun&bradstreet (2018)	Radgen and Blaustein (2001)	Sousa De Vasconcellos and Hambrick (1989)	Wiman Ohlson and Montalvo Kai (2018)
Reliability	✓		✓	✓	✓
Efficiency	✓	✓		✓	✓
Investment cost			✓		✓
Application-specific solutions	✓				
After-sales service				✓	
Low maintenance costs	✓	✓			
Capacity	✓				
Air quality			✓		

A.8 IP-strength

Table A.10: R&D intensity and patents by main competitors.

Company	R&D intensity (%)	Number of patents
Competitor A	2.8%	4,442
Competitor B	3.3%	309
Competitor C	1.5%	4
Competitor D	0.9%	235
Competitor E	2.2%	543

Note: Number of patents found by searching for "compressed air" and company name in Google Patents.
Source: Yahoo Finance, company annual reports and Google Patents.

Table A.11: Selected IP strength rankings.

Country	IP strength
United States	42.66
United Kingdom	42.22
Sweden	41.03
Poland	29.94
Malaysia	22.37
China	21.45
India	16.22

Source: Global Innovation Policy Center (2019).

A.9 Data relevant to analysis of do-or-buy and location decisions

Competitors Operations

Competitor A has a global network of operations which includes; Japan, the U.S., Canada, Brazil, Germany, Italy, Finland, Netherlands, Belgium, the Czech Republic, France, Austria, Russia, Poland, South Korea, U.K, Singapore, India, Philippines, Vietnam, Thailand, China, Australia, and South Africa (Competitor A, 2019). Competitor A is one of the competitors with the largest global presence in terms of production.

Competitor B is present in multiple countries with the manufacturing and development scattered around the world. The principal countries which Competitor B is present are; Belgium, the U.S., China, South Korea, India, Germany, Italy, Canada, Sweden, the Czech Republic, U.K, France, and Japan (MarketLine, 2018*a*).

With its 52 manufacturing plants worldwide Competitor C has operations in a diverse set of countries and continents. Competitor C has operations within the following countries; the U.S., Brazil, Mexico, Spain, Italy, France, Germany, Ireland, Saudi Arabia, the Czech Republic, Thailand, Malaysia, China, and India (MarketLine, 2019*b*).

Competitor D has operations in but not restricted to the following countries; Germany, the United Kingdom, China, Finland, Italy, and India. Furthermore, the company has a total of 41 manufacturing facilities worldwide of which 18 are located in the Americas, 19 in EMEA (Europe, Middle East, and Africa), and 4 in APAC (Asia Pacific) (Competitor D, 2019).

Competitor E, like others, is present in a multitude of countries and continents. However, Competitor E has one of the humblest global coverage of operations which includes facilities in Korea, China, the U.S., Norway, Czech Republic, France, and Ireland (Competitor E, 2019).

Assessing potential locations

Factory costs

Table A.12: The average cost (in EUR) of prime industrial rents in selected European countries.

	Germany	Sweden	Bulgaria	Poland
Country average	65.93	90.7	48	42

Source: Cushman and Wakefield (2018*c*, 2017, 2018*b*,*a*)

Table A.13: Building costs 2018 per m^2 in USD.

	China	India	Malysia	Poland	Bulgaria*	Sweden**	Germany
Warehouse/-factory units basic	367	403	557	546	643	1044	810
Large warehouse distribution centre	422	527	714	734	864	1304	1012
High tech factory/laboratory	938	698	1193	1107	1304	2991	2321

Note: *The Bulgarian building costs are estimated using the prices of Poland and adjusted with the price level differences of the two countries. **Same as for Bulgaria but using Germany as base. Eurostat (2019*a*) where used as basis for the price difference.

Source: Turner & Townsend (2018).

Table A.14: Hidden costs of outsourcing in percentage of the total outsourcing cost.

Type of cost	**Percent of total outsourcing cost**
Outsourcing contract	1-2%
Transfer of know-how	5-7%
Travel costs	2-3%
Transfer of activities	1-2%
Communication	0-20%
Changing of business processes	0-10%
Cultural diversity	2-5%
Total	**12-52%**

Source: Dvořáček (2010).

Labor cost

Table A.15: Mean nominal monthly earnings of employees by economic activity and country.

Economic activity / Country	Mining	Manufacturing	Construction
India	N/A	N/A	N/A
Malaysia	1,180	513	494
Bulgaria	786	473	438
China	759	746	653
Poland	1,733	972	840
Sweden*	5,791	5,182	5,028

Note: *Sweden's numbers are based on 2015 instead of 2016 like the rest in absence of updated figures.

Source: International Labour Organization (2019)

Cost of capital

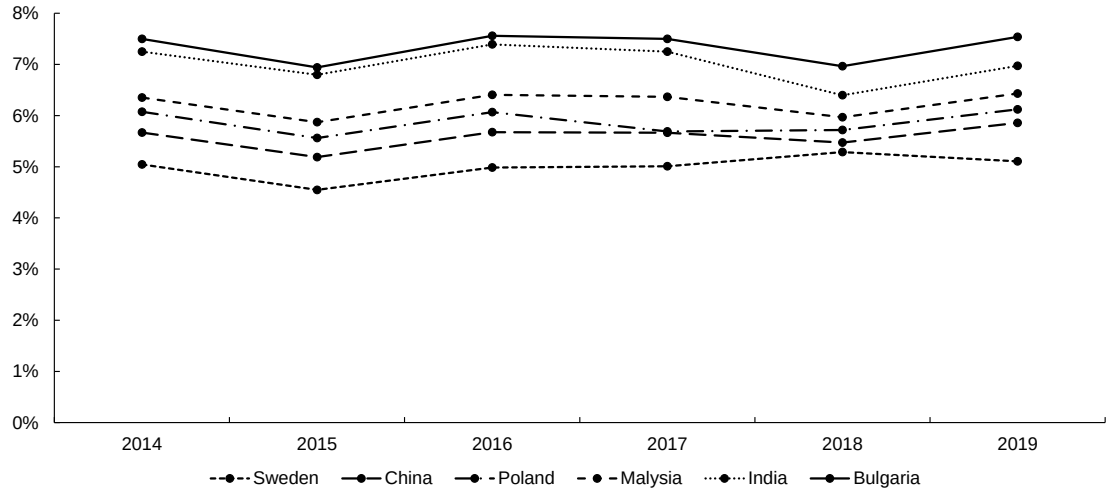
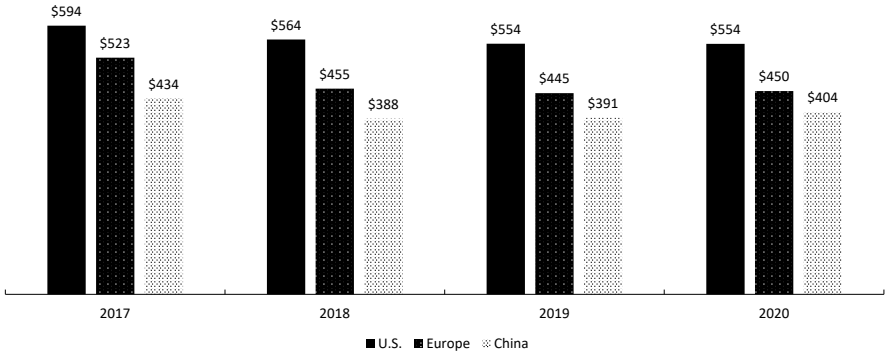


Figure A.6: Regional cost of capital between 2014 until 2019.

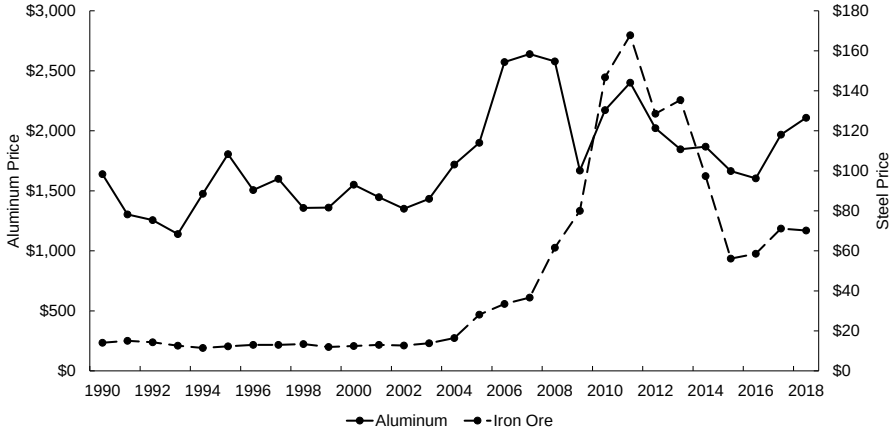
Note: The cost of capital is calculated based on the definition given by Damodaran (2015)

Source: Damodaran (2014, 2015, 2016, 2017, 2018, 2019), KPMG (2018).

Cost of materials



(a) Regional historical and forward looking steel prices.
Source: Statista (2019*a*).



(b) Global prices for Iron ore and Aluminum.
Source: International Monetary Fund (2019).

Figure A.7: Raw material prices.

Capital productivity

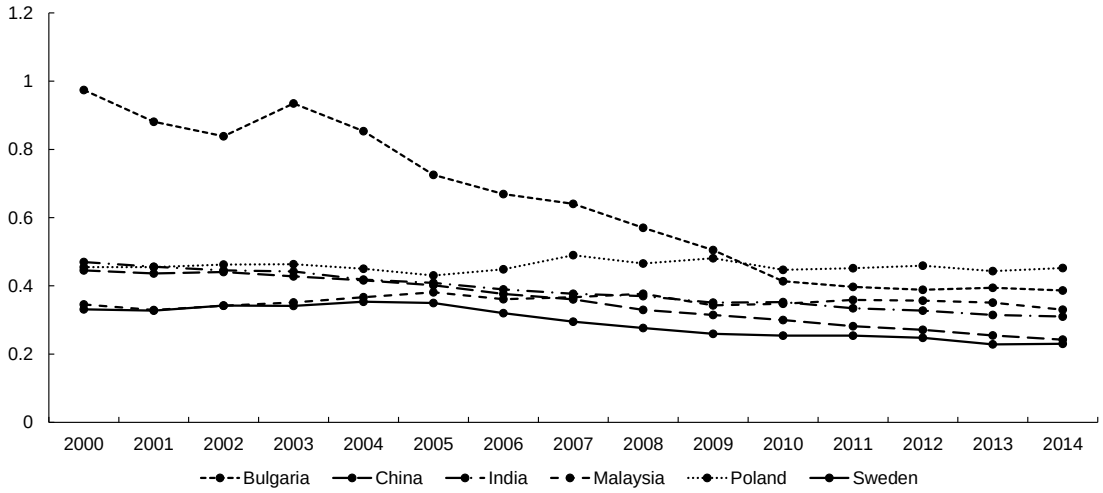


Figure A.8: Computed capital productivity 2000-2014.
Source: University of Groningen (2015).

Labor productivity

In measuring productivity there are generally a set of underlying reasons as of why to measure it from the start. OECD (2001) states five objectives of productivity measurement; technology–tracing the technological change, efficiency–how efficiently are technology and inputs used, real cost savings–identifying real cost savings within production, benchmark–identifying inefficiencies by comparison, living standards–tracing the living standards as they are highly correlated with labor productivity.

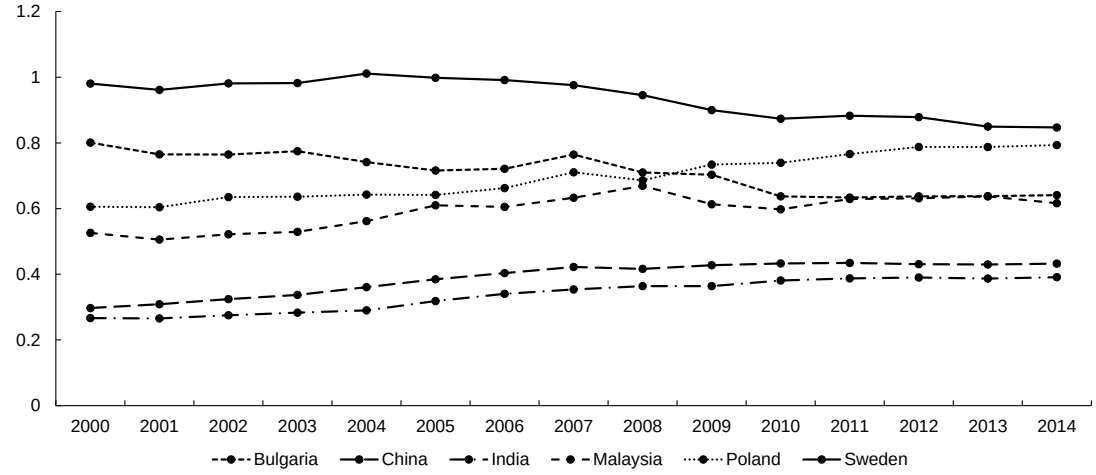


Figure A.9: Total factor productivity between 2000-2014.
Source: University of Groningen (2015)

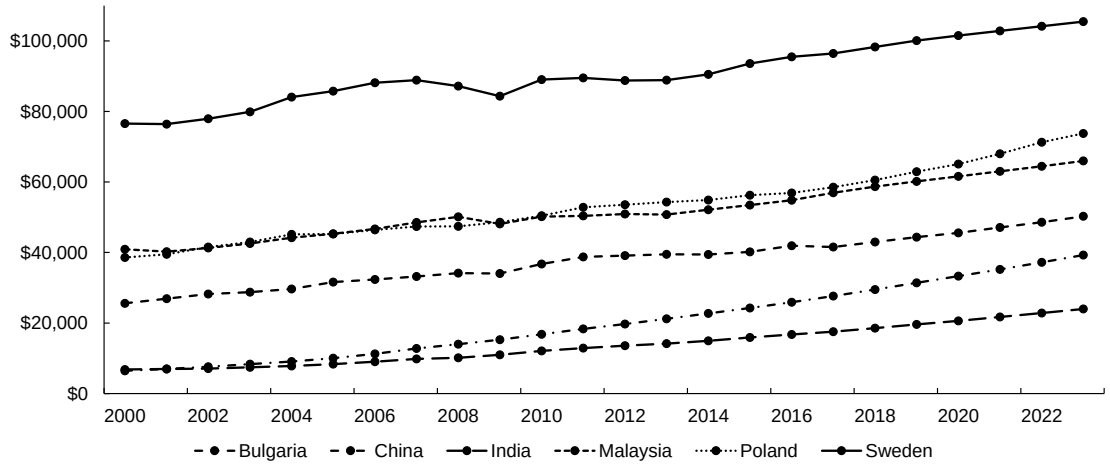


Figure A.10: Output per worker (GDP constant 2011 international $ in PPP)–ILO modelled estimates.
Source: International Labour Organization (2019).

Logistical and Business Indices

Firstly, the *Ease of Doing Business Index* – seen in Table A.16 in Appendix A.9–by The World Bank is a yearly ranking incorporating 190 countries which evaluating the regulatory environment for local firms. The ranking is based on ten underlying factors which are as follows; Starting a Business, Dealing with Construction Permits, Getting Electricity, Registering Property, Getting Credit, Protecting Minority Investors, Paying Taxes, Trading across Borders, Enforcing Contracts, and Resolving Insolvency. Each of the above-mentioned scores is also an aggregate of a set of underlying factors, which are out of scope for this thesis. A higher ranking signifies an environment which is more conducive to starting and operating a firm within the local environment (The World Bank, 2018*b*). Therefore, the ranking plays a critical role in the choice of location and is included.

Table A.16: Ease of doing business 2018 rankings.

	2018 Rank	**F1**	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**F8**	**F9**	**F10**
Sweden	12	18	25	9	10	85	33	27	18	38	17
Malaysia	15	122	3	4	29	32	2	72	48	33	41
Poland	33	121	40	58	41	32	57	69	1	53	25
China	46	28	121	14	27	73	64	114	65	6	61
Bulgaria	59	99	37	147	67	60	33	92	21	42	56
India	77	137	52	24	166	22	7	121	80	163	108

Note: F1: Starting a Business F2: Dealing with Construction Permits, F3: Getting Electricity F4: Registering Property, F5: Getting Credit F6: Protecting Minority Investors, F7: Paying Taxes, F8: Trading across Borders F9: Enforcing Contracts F10: Resolving Insolvency

Source: The World Bank (2018*b*).

Secondly, *The Enabling Trade Index*–seen in Table A.17 in Appendix A.9–by the World Economic Forum which judges to which extent countries facilitate the free flow of goods over borders and to their country a higher ranking indicates a higher degree of free flow of goods (World Economic Forum, 2016). The ranking is based upon seven pillars, namely; Domestic market access, Foreign market access, Efficiency and transparency of border administration, Availability and quality of transport infrastructure, Availability and quality of transport services, Availability and use of ICTs, and Operating environment.

Table A.17: Enabling Trade Index 2016.

	2016 Ranking	**P1**	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**
Sweden	5	54	77	3	21	5	2	6
Poland	31	42	29	24	47	37	44	52
Malaysia	37	43	107	47	17	29	35	26
Bulgaria	53	36	67	49	85	62	50	71
China	61	101	124	52	12	32	64	42
India	102	135	117	75	28	44	101	76

Note: P1: Domestic market access, P2: Foreign market access, P3: Efficiency and transparency of border administration, P4: Availability and quality of transport infrastructure, P5: Availability and quality of transport services, P6: Availability and use of ICTs, P7: Operating environment

Source: World Economic Forum (2016).

Thirdly, the *Logistics Performance Index*–seen in Table A.18 in Appendix A.9–by The World Bank is an index quantifying the logistical performance of each country or simply put how efficiently supply chains in different economies connect firms with markets (The World Bank, 2018*a*). As stated by The World Bank (2018*a*), the index is based on six components namely; the efficiency of customs and border management clearance, the quality of trade- and transport-related infrastructure, the ease of arranging competitively priced international shipments, the competence and quality of logistics services, the ability to track and trace consignments, and the frequency shipments reach consignees within the scheduled or expected delivery time.

Table A.18: Trade Logistics Index 2018.

	2018 Rank	**F1**	**F2**	**F3**	**F4**	**F5**	**F6**
Sweden	2	2	3	2	10	17	7
China	26	31	20	18	27	27	27
Poland	28	33	35	12	29	31	23
Malaysia	41	43	40	32	36	47	53
India	44	40	52	44	42	38	52
Bulgaria	52	42	64	41	55	59	65

Note: F1: Customs, F2: Infrastructure, F3: International shipments, F4: Logistics competence, F5: Tracking & tracing, F6: Timeliness

Source: The World Bank (2018*a*).

A.10 Different scenarios impact on business performance

Table A.19: Estimated impact of utilizing global sourcing.

Country	Materials	Components	Manufacturing	Transportation	Total	Savings
Sweden	100%	100%	100%	0%	100%	0%
Bulgaria	100%	100%	100%	0%	100%	0%
Poland	100%	100%	100%	0%	100%	0%
China	88%	88%	100%	100%	94%	6%
India	88%	88%	100%	100%	94%	6%
Malaysia	88%	88%	100%	100%	94%	6%

Note: Estimation based on scenario in which the case company is sourcing raw materials and components from the cheapest possible location, including transportation costs.

Table A.20: Estimated impact of utilizing offshoring.

Country	Materials	Components	Manufacturing	Transportation	Total	Savings
Sweden	100%	100%	100%	0%	100%	0%
Bulgaria	100%	100%	26%	0%	65%	35%
Poland	100%	100%	60%	0%	81%	19%
China	88%	88%	70%	100%	80%	20%
India	88%	88%	26%	100%	60%	40%
Malaysia	88%	88%	25%	100%	59%	41%

Note: Estimation based on scenario in which the case company is utilizing offshoring combined with local sourcing. Labor cost amount to 77.2% of manufacturing costs as per OECD (2009).

A.11 Estimations of cost structure and unit costs as a function of volume

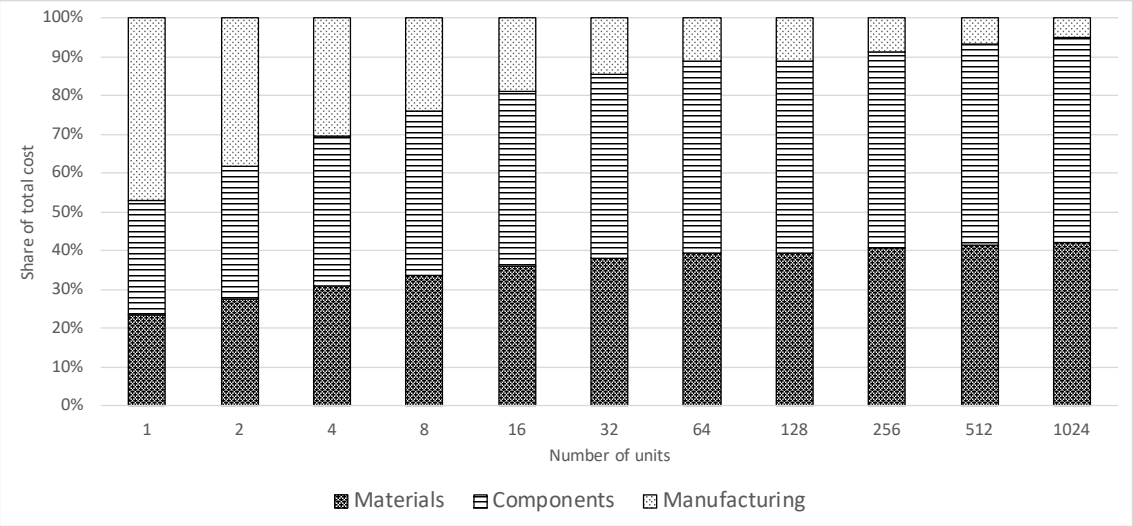
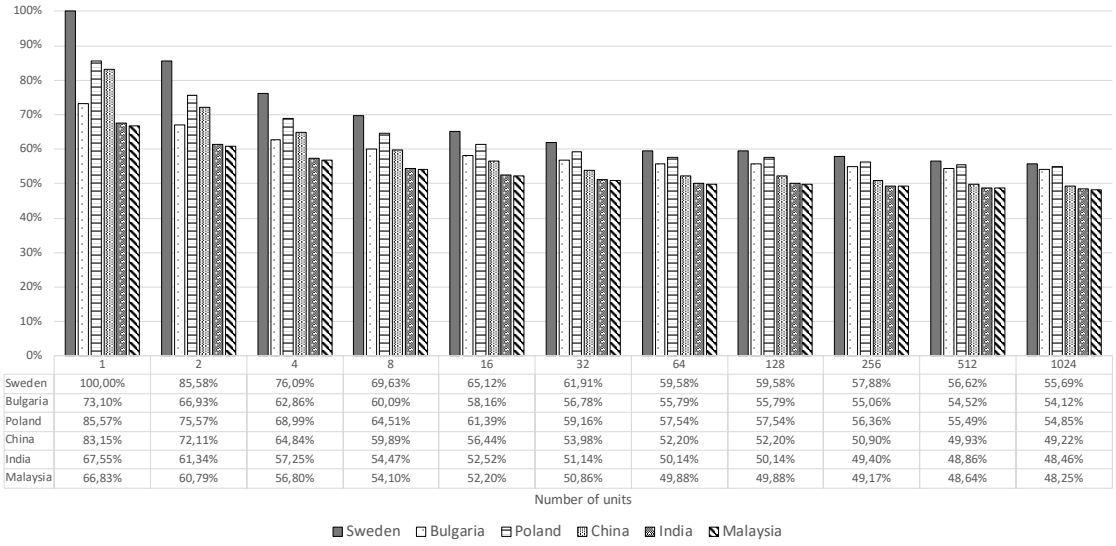


Figure A.11: Cost structure as a function of volume for Sweden.

Note: Scenario assumes the case company are able to achieve both learning effects and economies of scale.



	1	2	4	8	16	32	64	128	256	512	1024
Sweden	100,00%	85,58%	76,09%	69,63%	65,12%	61,91%	59,58%	59,58%	57,88%	56,62%	55,69%
Bulgaria	73,10%	66,93%	62,86%	60,09%	58,16%	56,78%	55,79%	55,79%	55,06%	54,52%	54,12%
Poland	85,57%	75,57%	68,99%	64,51%	61,39%	59,16%	57,54%	57,54%	56,36%	55,49%	54,85%
China	83,15%	72,11%	64,84%	59,89%	56,44%	53,98%	52,20%	52,20%	50,90%	49,93%	49,22%
India	67,55%	61,34%	57,25%	54,47%	52,52%	51,14%	50,14%	50,14%	49,40%	48,86%	48,46%
Malaysia	66,83%	60,79%	56,80%	54,10%	52,20%	50,86%	49,88%	49,88%	49,17%	48,64%	48,25%

Figure A.12: Unit cost in percentage of original unit cost as a function of volume for each of the assessed countries.

Note: Scenario assumes the case company are able to achieve both learning effects and economies of scale.

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