UNIVERSITY OF VAASA

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"ALIGNMENT OF BUSINESS STRATEGY AND SUPPLY CHAIN MANAGEMENT:

a study of medium-to-large-sized internationalized German companies from an international business student perspective"

Master's Thesis in International Business

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LIST OF ABBREVIATIONS

B2B	Business to Business
B2C	Business to Customer
CEO	Chief Executive Officer
CSCMP	The Council of Supply Chain Management Professionals
GMPs	Good Manufacturing Practices
IB	International Business
IB	International Business Student
KPI	Key Performance Indicator
NPI	New Product Introduction
SC	Supply Chain
SCM	Supply Chain Management
SMEs	Small-and Medium-Sized Enterprises
PwC	PricewaterhouseCoopers
R&D	Research and Development
USP	Unique Selling Proposition
VMI	Vendor-Managed Inventory
vs.	versus

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ABSTRACT

In an increasingly globalized world, effective supply chain management and its alignment with a company's business strategy is seen as a firm's competitive advantage. Existing studies, which were conducted in internationally known companies, suggest three main strategies: Lean, agile and leagile supply chain strategies. Lean supply chain strategies in markets with a stable demand follow a cost-minimizing approach. Agile supply chain strategies in markets with an unpredictable demand focus on differentiation, innovation and flexibility in order to fulfill customer-specific demand. Finally, leagile supply chain strategies try to combine lean aspects for a base demand and agile aspects for more customer specification. This study researches internationalized medium-to-large-sized German companies with the purpose of understanding how companies can improve their supply chain management from an international business perspective. Results are based on the analysis of qualitative data collected through 14 semi-structured interviews with employees from the SC or business department. Findings suggest that lean, agile and leagile supply chains exist as described in the literature. Furthermore, the supply chain strategies called 'project' SC and 'capable' SC were found. Project SCs are used for a fixed period of time in order to conduct customer-specific ventures. They are a specialized version of agile SCs with the difference that they are constructed from scratch. Capable SCs are characterized by delivery reliability and speed and customer closeness in markets with predictable demand. They can be considered an advancement of leagile SCs. Furthermore risk-hedging SC management was researched. Moreover, the changes in strategies over the years were examined and the meaning of increased automation and usage of computerized systems in the context of industry 4.0 were questioned. The results show that changes and technology play different roles according to industry. In conclusion the findings cannot be generalized due to the small sample size. However, the results give an insight into current supply chain management strategies that can lead to the practical implication of integrating the customer more in the SC. In the future SCs could have increased transparency, flexibility, and simultaneity. Further quantitative research is recommended.

KEYWORDS: Supply chain management, Business strategy, German companies

1. INTRODUCTION

This chapter gives an introductory overview of the study's topic, which divided into four parts. First, the background of the study is presented and the contribution of the research is demonstrated. Secondly, the research question and objectives are defined. Thirdly, the research perspective of the study is explained. Finally, the main concepts and definitions are introduced.

1.1 Background of the study

Nowadays effective supply chain management is seen as a firm's competitive advantage alongside networks and alliances. Actually, a typical industrial company spends more than 50% of every sales dollar on supply chain cost in the fields of sourcing, making and delivering. Furthermore, due to trends of outsourcing and downsizing, this percentage is rising (Dyer, Cho & Chu 1998: 57). This is why supply chain management and sourcing performance are important competitive advantages (Porter 1998). Moreover, companies invest a total of 20 billion dollars annually in information systems that are supposed to improve supply chain performance. However, almost half of all companies continue to be disappointed with their supply chain performance (Heckmann, Shorten & Engel 2003). This shows that not only technology, but also strategy and management are key drivers.

However, nowadays there are also trends of growing technological usage because the supply chain is the distinguishing competitive factor in an increasingly globalized world with a growing complex environment. Industry 4.0 has the objective to computerize manufacturing and to digitalize industries. It was originally implemented according to a high-tech initiative of the German government (Bundesministerium für Bildung und Forschung 2016). In order to be able to achieve this level of automation and digitalization, computerized systems continue to play an increasingly important role. The question is what are the changes that companies conducted over the years and which level of digitalization makes sense for companies in the future. Industry 4.0 in

relation to supply chain management leads to the topic of end-to-end cross-linking, which is considered the SC of the future in order to be able to fulfill an increasingly complex customer demand.

Moreover, studies find that companies that synchronize their supply chain architectures and business objectives achieve an overall superior performance. The synchronized supply chains are easier implemented, operated and they can be redesigned quickly according to changing business needs (Cohen & Roussel 2005: 27). Hauguel and Jackson (2001) conducted a survey of 300 large European and US companies and found that 68% of the companies plan to improve their supply chain. This shows the importance that was and continues to be linked to supply chain management in the current management world.

This project will try to unify two important aspects of business studies – business strategy and supply chain management. Every business needs a business strategy in order to know what it operates for, how it builds up its competitive advantages and what it wants to achieve. The business strategy is the overall leading principle of a company's objectives. Moreover, every business needs to have some kind of supply chain strategy in order to obtain the supplies that are needed for its operations and to deliver with the required performance. Thus, the supply chain is seen as a unit that is responsible for a company achieving and maintaining a competitive advantage. This is why it is important to see these two important factors for a company's success in alignment.

Currently there are a lot of interesting new insights and changes concerning supply chain management (Global Supply Chain Institute 2013). There have been plenty of studies concerning supply chain management in the context of industrial economics (Sillanpää & Sillanpää 2014: 95). Furthermore, many studies claim that the supply chain strategy must reflect the business strategy (Schnetzler, Sennheiser & Schönsleben 2007; Harrison & New 2002; Christopher, Peck & Towill 2006; Chopra & Meindel 2007; Waters 2009). A survey by Harrison and New (2002) found that two-thirds of the respondents reckoned that their supply chain strategy was significant or highly significant in regards of the business strategy. However, there is still a research gap

between these two strategies (Rose, Singh Mann & Rose 2012: 6). Thus, the study of the alignment of supply chain management and business strategy can lead to new findings and identification of potential improvements.

Researching German companies is relevant as Germany is one of the leading economic players. Furthermore, SC management specifically in Germany has not been researched yet. It may be possible to learn from the supply chain management that is conducted in German companies, as there are many internationally important companies. As a result this study could support firms in improving their supply chains to match them better to their business objectives. The next paragraph introduces the research question, delimitations and objectives of the study.

1.2 Research question, delimitations and objectives

The main issue is that companies' supply chain strategies are not always tailored to suit their business strategies. Therefore the main goal is to understand currently used supply chain strategies and then to identify which supply chain strategy fits best to which business strategy. This will be achieved by combining empirical studies with a theoretical framework in order to get a deeper understanding of how to design supply chains according to the business strategy of companies. The delimitations of the study are to find out in which ways a company's supply chain strategy can be aligned with a company's business strategy and to examine which kind of alignment will achieve the best possible results. Searching for and interviewing people who are responsible for the supply chain management, operations and business of medium-to-large-sized companies that have a significant degree of internationalization will achieve this objective. These characteristics are selected to enable a comparison with results of existing studies. Furthermore, these features should allow obtaining significant results. Furthermore, the research perspective is the one of an international business student.

Thus, the research question is "How is the supply chain management/ strategy aligned with the business strategy in medium-to-large-sized internationalized German

companies from an international business perspective?" The focus will be on both B2C and B2B as few of the existing studies specify if they concentrate on a company's B2B or B2C supply chain.

Sub-goals for the theoretical part are

- to collect and review the existing literature related to supply chain management and business strategy in order to obtain a comprehensive understanding of the terms,
- to analyze the literature concerning the alignment of supply chain management and business strategy and thus
- to develop a theoretical framework that visualizes which supply chain management strategy fits best to which business strategy.

Sub-goals for the empirical part are

- to question the superiority of the agile SC,
- to examine leagile supply chains and thus to research risk-hedging SCs and SCs which focus on operational excellence in order to define sub-categories or find new kinds of SCs and then
- to adjust the framework for German medium-to-large-sized companies from an international business student perspective.

The contribution of the study is to focus specifically on examining the alignment of business and SC strategy while other studies have analyzed these fields separately. Furthermore, German medium-to-large-sized companies are specifically researched. So far other studies have focused on the European continent, but not especially on German firms. Furthermore, the thesis aims to further examine leagile supply chains, as by now, studies have not found many distinguishing results. Examining leagile SCs in more depth can lead to a clearer definition of this kind of strategy. Moreover, further subcategories or new kinds of SC strategies could be found. Another goal is to examine the truthfulness of some researchers' claim of the superiority of the agile SC in comparison to other SC strategies. Then, as a result of the study, the theoretical framework is adjusted.

1.3 Research perspective

In this part the research perspective is explained. The main viewpoint of this thesis is from an international business (student) perspective. By selecting companies or subsidiaries that are internationally operating, both on national or foreign soil, the study gained an international background. Previous research, which was used in the theoretical part, has mostly been conducted by the economist and business strategist Michael Porter and the SC consultants Shoshanah Cohen and Joseph Roussel. These authors are well known for their contribution to academic research. Although the range of authors encompasses backgrounds of technology, technology management, (industrial) engineering, (international) logistics management, business, marketing, business consulting, economics, operations and supply chain, it does not specifically include a background in international business. In summary the authors have technology/ engineering-related and generally business – related backgrounds. Abrahamson and Rehme have had specifically an international background (in logistics). While Porter formulated fundamental business strategies with an international business and economic background in mind, he did not specifically examine SCM from these viewpoints. To examine both business strategy and SCM, the selected perspective in this thesis is the one of an international business student. Thus, the thesis gives a fresh view on the topic. The influence of the research perspective is illustrated in the following figure (figure 1). Afterwards the main concepts and definitions are explained.

1.4 Main concepts and definitions

The main concepts that are used in this study are shortly defined below:

CORPORATE STRATEGY - is the question of how a company adds value. The governing strategy is dependent on the size of the firm with bigger firms having a guiding corporate strategy and several business strategies and smaller firms having only one business strategy. In general the distinguishing competitive factor for a company is

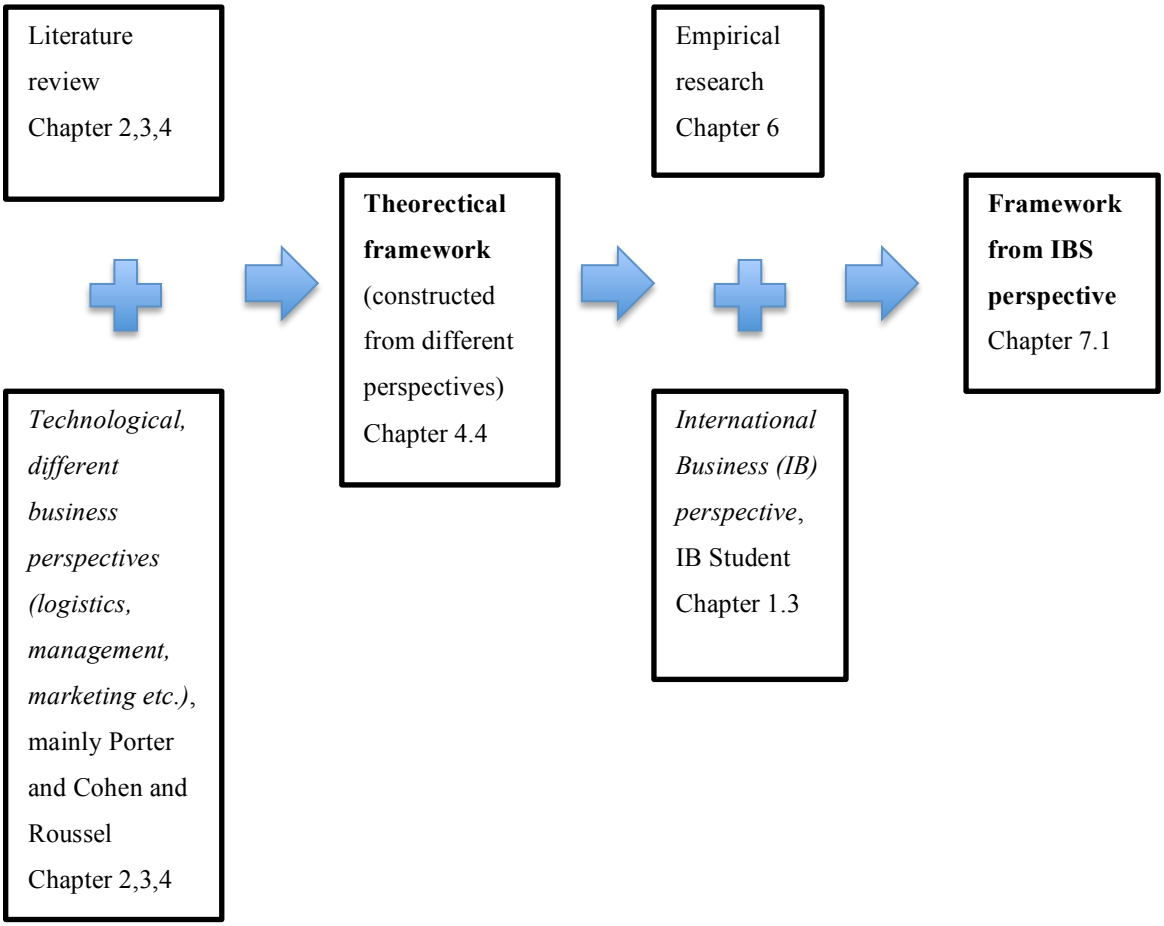

Figure 1: Influence of research perspectives.

its corporate strategy (Waters 2009).

BUSINESS STRATEGY - is subordinated to the corporate strategy and the guiding strategy of a business unit. This term is often used interchangeably in literature with corporate strategy (Waters 2009). However, in this thesis the intention is to keep a clear distinction between the two terms.

SUPPLY CHAIN MANAGEMENT – is foremost responsible for linking the key business functions and processes within and across firms into a connected and well-functioning business model. "It involves planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management

activities." (CSCMP 2012). Moreover, it concerns the coordination and collaboration with channel partners (CSMP 2012).

SUPPLY CHAIN STRATEGY - is the strategy of supply chain management. Supply chain management seeks for a balance between an efficient and responsive strategy (Chopra & Meindl 2007). The main supply chain strategies found in literature are lean, agile or leagile strategies (explained below).

SUPPLY CHAIN FUNCTIONS – are mainly to plan, source, make, deliver and return (Sillanpää & Sillanpää 2014: 101).

LEAN – SCs are smooth, forecast-driven operations, which aim to minimize waste from production to delivery. Thus, they represent cost-efficiency (Goldsby et al. 2006; Cohen & Roussel 2005).

AGILE – SCs are demand-driven and react flexibly to unpredictable situations. They focus on understanding and meeting customer-specific needs (Cohen & Roussel 2005).

LEAGILE – SCs are basically a hybrid version of lean and agile SCs. They aim to combine lean aspects for a base demand and agile aspects for more customization (Cohen & Roussel 2005).

2. BUSINESS STRATEGY

The second, third and fourth chapter deal with building the theoretical framework based on the review of existing literature. The second chapter deals with business strategy, corporate strategy and competitive strategy. The structure of this chapter starts with a definition of the term business/ corporate strategy, then gives an overview of the existing business strategies by Porter (1980) and Cohen and Roussel (2005) and finally consolidates these approaches.

The choices of literature focus on two important books. First, it is and Porter's *Competitive strategy: Techniques for analyzing industries and competitors* (1980) and secondly Cohen and Roussel's book *Strategic supply chain management* (2005). Although Porter's book is originally from 1980, his theories are fundamental in business studies and are still in use in every day's business processes and management. Therefore they prove to be ongoing relevant these days. Moreover, the book is based on cross-industry observations and has been subject to significant empirical testing. Finally, Porter's article *What is strategy* (1996) is added.

2.1 Defining corporate strategy, business strategy and competitive strategy

Strategy can be found at different levels in a firm (see figure 2). The mission at the highest level represents the comprehensive function and objectives of the whole organization. Next, corporate strategy is also on the level of the whole organization and serves to show how to reach the mission. A corporate strategy is an essential part for a firm to be successful. It supports growth and helps a company to achieve its goals. In general, it concerns the question of how a company adds value. It is the overall governing strategy, often internationally oriented. Subordinated to the corporate strategy are the business strategies for each business unit. A business strategy should encompass the competitive strategy, meaning that the competitive strategy is an important part of the business strategy. All existing business strategies in one company should be transferred into a functioning business model. In the business model the business

strategies link the three parts out of which it consists, which are customer value proposition, operating model and profit model. For the execution in order to achieve value-adding processes, a firm has to invest in resources, develop a business portfolio and design the structure, systems and corporate functions of the organization in order to have activities and skills transferred across the company (Sharer 2016). The topic of the thesis is to align the SC strategy with the business strategy in the respective business unit.

Ranked below the business strategies are the functional strategies for each functional unit. Depending on the size of the firm there might only exist one business unit and therefore only one corporate/ business strategy (Waters 2009). This is why corporate strategy and business strategy are used interchangeably in literature. However, in this research the intention is to have a clear distinction between the terms.

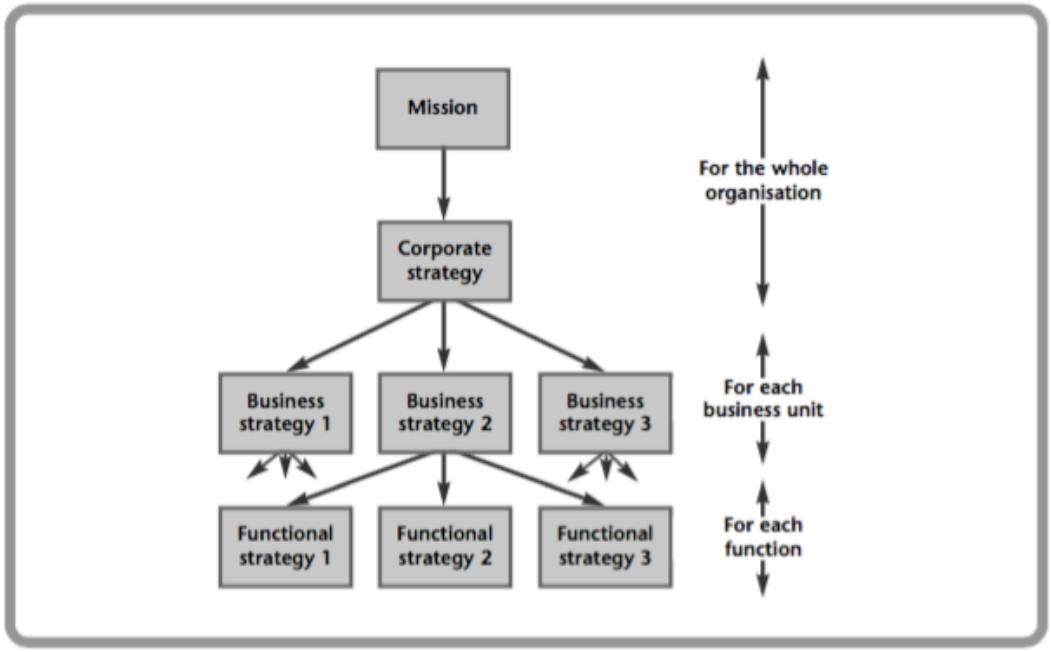

Figure 2: Types of strategic decisions (Waters 2009: 61).

The business strategy determines the direction and look of a business. It helps determining priorities for the management and for each department, attracting a talented

workforce, defining the target group, meeting customers' expectations, allocating resources and maintaining a competitive advantage (FastTrac Kauffman Foundation 2016). In conclusion the business strategy gives a company the opportunity to win its specific target market (Favaro 2012). The following questions should be answered with the business strategy:

- Why is the company operating in business?
- What is the firm best at doing?
- What is the company's target market? / Which customer segments should the company continue to serve or start serving?
- What is the value proposition to the customer?
- What are the essential capabilities that are required to deliver this value proposition?
- Which products/ services should the firm start offering, continue to offer, or stop offering?
- In what geographic markets should the firm operate?
- Why has the firm decided on these strategic directions?
- How does the company generate profits? (FastTrac Kauffman Foundation & Favaro 2012).

The competitive strategy determines the policies to achieve and maintain a leading position. Actually, the competitive strategy is an important part of the business strategy. Policies or actions of functional departments should be coordinated according to a common set of objectives. The following figure (figure 3) shows the four components that a company should consider when determining its competitive strategy. On the internal side of the company are its strengths and weaknesses meaning the company's skills and assets on the one hand. On the other hand are the personal values of the key implementers, which mean the key players' needs and motivations. The factors on the external side encompass the industry's opportunities and threats on the one hand and the broader societal expectations like governmental policies and society's concerns on the other hand (Porter 1980: xxvi).

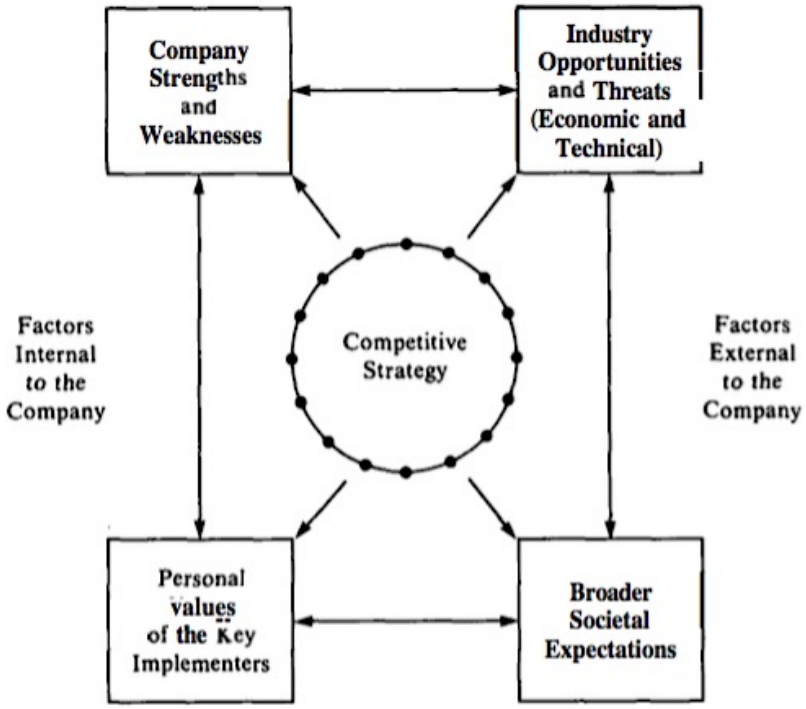

Figure 3: Context in which a competitive strategy is formulated (Porter 1980: xxvi).

Next, Figure 4 illustrates the five forces that drive industry competition. These five forces are the threat of new entrants, the bargaining power of suppliers and buyers and the threat of substitute products/ services, which finally lead to the rivalry among existing firms. This model shows that each company requires a unique construction according to these five forces (Porter 1980: 34).

Porter (1996: 1) also claims that a competitive advantage can only be achieved temporarily in the best case. Some researchers state that a strategy of positioning is considered too static as competitors can easily copy one's market position. Yet Porter states that companies that are not distinguishing clearly between operational effectiveness and strategy are the dominating cause for strong rivalry. The resulting need to improve all aspects of a company's business leads to less successful competitive positions. According to Porter (1996: 36), the operational area is the right place for ongoing change, flexibility and striving to be best in practice. The strategic area involves defining a unique position, making clear trade-offs and conducting a close fit.

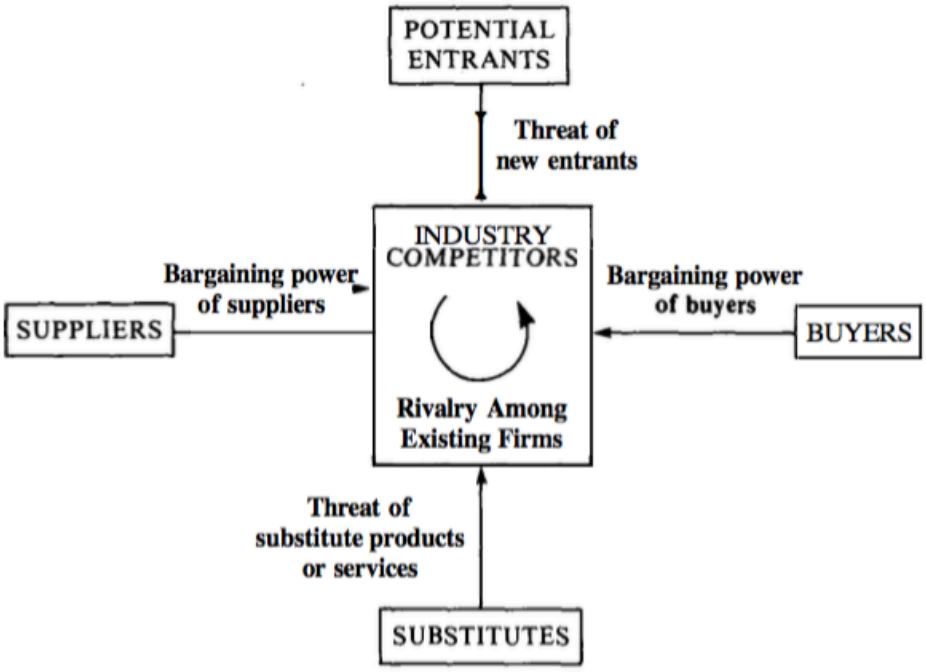

Figure 4: Five forces driving industry competition (Porter 1980: 4).

Furthermore, Porter explains that "positioning requires a tailored set of activities" (1996: 16) as it represents a supply side that always functions differently. Furthermore, trade-offs are decisive strategic factors in order to limit a company's range of offers (1996: 19). Next, exchange of information and coordination of activities are basic optimization techniques in order to avoid vain activities (Porter 1996: 25). After all, a competitive advantage is the result of an entire interconnected system of actions (Porter 1996: 26).

2.2 Overview of business strategies

There exist two models of business strategies with which companies compete against each other. The first model is called Porter's (1980) three generic strategies. It differentiates between overall cost leadership, differentiation and focus. The second one is by Cohen and Roussel (2005). It differentiates between the primary strategies of

innovation, cost, service and quality. Furthermore, Roh, Hong and Park's model (2008) adds the strategy of flexibility. In the following part the models will be presented. Furthermore, they will be aligned to present a common ground as the basis for the alignment with supply chain management and strategies.

2.2.1 Porter: Three generic strategies

Broadly there exist three internally consistent generic strategies that can be used solely or combined in order to create a powerful position and to outperform the competition (Porter 1980: 35). These are overall cost leadership, differentiation and focus.

The first strategy is overall cost leadership. Porter (1996: 2) describes it as follows. "Cost is generated by performing activities, and cost advantage arises from performing particular activities more efficiently than competitors." It is a useful strategy against rivalry and against powerful buyers who both try to drive down prices. Furthermore, this position allows flexibility of handling suppliers. Moreover, it is a useful strategy against substitutes. Scale economies and cost advantages provide entry barriers. Requirements for this position are features like having a relatively high market share or facilitated access to raw materials. Furthermore, products should be easy to manufacture by having related or standardized characteristics. Moreover, a market consisting of all main customer groups should be served in high volume. At the same time this strategy requires a high amount of up-front capital investment, modern equipment, tight control systems and incentives that are based on strict targets with aggressive pricing strategies, which in turn may often lead to short-term losses. Once the goal is reached, this position allows generating high margins that in turn can be reinvested (Porter 1980: 36). However, the need to keep pace with technological advancements and the strong focus on keeping costs low, impose significant risks (Porter 1980: 45).

Differentiation can take the forms of design or brand image, technology, features, customer service, dealer network etc. Porter (1996: 2) claims "differentiation arises from both the choice of activities and how they are performed." It is important for a firm to be able to differentiate concerning a number of dimensions (Porter 1980: 37). This strategy allows a company to have a strong position against rivalry and substitutes

due to their customer's loyalty and lowered price sensitivity. The uniqueness of the strategy of differentiation provides an entry barrier. Differentiation yields higher profit margins that allow power over suppliers and alleviates buyer power due to the decreased price sensitivity. However, a high risk factor is that buyers actually do not perceive a high need for differentiation (Porter 1980: 46). The requirements for this strategy encompass strong marketing and engineering skills, a corporate reputation and tradition for leadership, strong cooperation of internal channels and subjective incentives based on quality instead of on quantitative measures (Porter 1980: 41).

Focus strategy means concentrating on a particular segment of the product line, geographic market or buyer group. The strategy is based on the assumption that the firm can serve a particular target better than a more broadly oriented competitor by achieving better differentiation and/ or lower costs while serving the market (Porter 1980: 39). The highest risk factor is to maintain the advantages of the focused firm in contrast to the broader operating firm (Porter 1980: 46). The requirements encompass a combination of the ones needed for overall cost leadership and differentiation (Porter 1980: 41).

Figure 5 provides an overview of the three generic strategies. The vertical axis differentiates between the industry-wide strategic targets versus particular segments. The horizontal axis differentiates between the strategic advantage of either uniqueness or low cost position.

2.2.2 Cohen and Roussel: Four primary strategies

While Porter discusses business strategies on a general high-level perspective, Cohen and Roussel (2005) use a more operative viewpoint. They already integrate implications for operation and supply chain. According to them, there are four typical strategies that companies use to compete: innovation, cost, service, and quality. These strategies are also known as a company's basis of competition. Leading companies usually concentrate on one primary strategy (Cohen & Roussel 2005: 22).

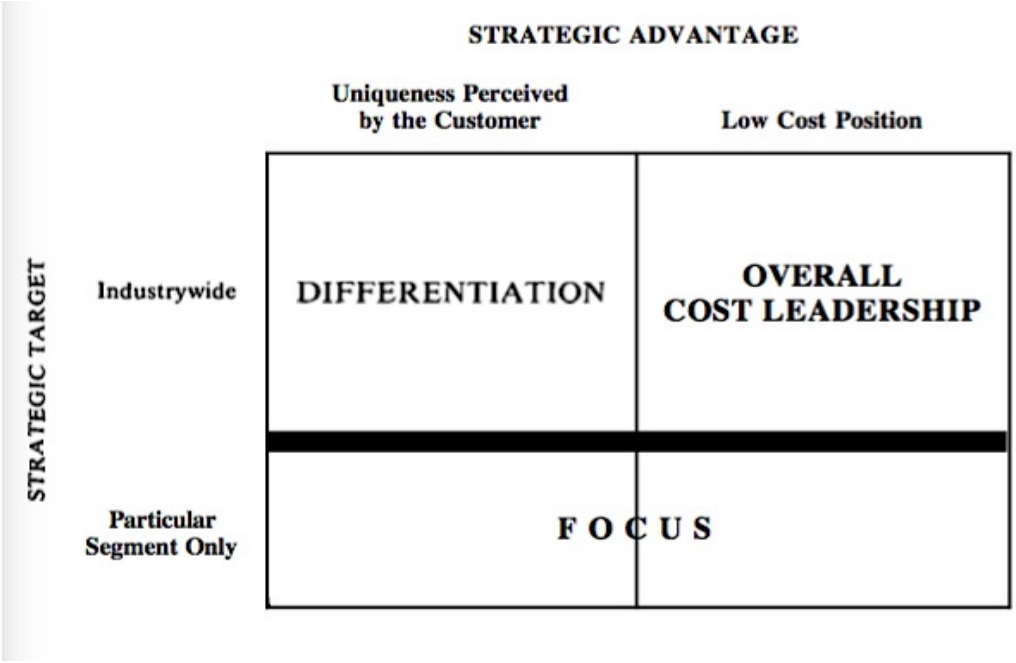

Figure 5: Three generic strategies (Porter 1980: 39).

Competing on innovation usually means to develop category killers that create consumer pull by branding or a unique technology, which allows these companies to charge a price premium. Here, an integration of the supply chain with the design chain that involves all innovatively acting parties is important in order to reduce the time to market. This should ultimately lead to a dedicated new product introduction supply chain (Cohen & Roussel 2005: 52). Additionally, an important feature is the time-to-volume advantage meaning that a strong demand, which was created, can be fulfilled (Cohen & Roussel 2005: 24).

Companies, which choose to compete on cost, offer lowest prices possible for cost-sensitive customers in a product category or maintain a share in a market of commodities. Conditions for this strategy are efficient, integrated operations and a low-cost supply chain. Furthermore, the metrics are efficiency-based. The standardization of process and product as well as production quality, sourcing quality and inventory control are important factors (Cohen & Roussel 2005: 22). Critical supply chain practices are the integration of factory planning and timing, the standardization of raw

materials and manufacturing process and the design for order management, procurement and manufacturing (Cohen & Roussel 2005: 52).

Companies that compete on service, adjust their service offerings according to their customers' needs and strive to have a reputation for superior customer service in order to buildup customer loyalty. Companies that lead in this field know how to segment their customers and determine the cost of customized service. With this information companies influence their customer service profitability (Cohen & Roussel 2005: 26). For this strategy, critical supply chain practices include customer collaborative planning, customer segmentation and service level management (Cohen & Roussel 2005: 52).

Products and services produced by companies competing on quality have a premium nature and a consistent and reliable performance. Product development and key supply chain processes are critical factors for quality. A key attribute is traceability, which means tracing a product back to its source (Cohen & Roussel 2005: 25). It allows tracing a product back to its origin, thus allowing full transparency of all production steps.

The following table (table 1) shows Roh, Hong and Park's (2008) competitive priorities along with their respective organizational cultural elements. He differentiates between cost, quality, flexibility and innovation as competitive priorities. Roh, Hong and Park demonstrate that flexibility is another competitive strategy to consider while the other ones are equal to Cohen and Roussel's strategies.

Table 1: Competitive priorities (Roh, Hong & Park 2008).

Competitive priorities	**Organizational culture elements**
Cost	Minimize the impact of individual differences, standardization, repetitive and predictable environment, internal effectiveness, economy of scale, bureaucracy

Competitive priorities	Organizational culture elements
Quality	Knowledge work/sharing, skill acquisition and development, continuous improvement, teamwork, empowerment
Flexibility	High technology, adaptable workforce, creativity and imitative, unpredictable environment, internal and external effectiveness
Innovation	Creativity, adaptation, open communication and continuous learning, autonomy

In conclusion leading companies know how to differentiate themselves by focusing on their main competitive aspect, which they drive to perfection. This gives them the opportunity of achieving a competitive advantage. In this context the supply chain can support each aspect of the business strategy. Therefore, alignment of SC and business strategy should be prioritized.

2.3 Consolidation of the different business strategies

Both Porter (1980) and Cohen and Roussel (2005) define a strategy that focuses on cost, called ‘overall cost leadership’ and ‘cost’ respectively. These kind of strategies cope with cost advantages achieved by scale economies that use standardized, efficient and integrated operations for a range of standardized products. Furthermore, both models define a strategy for innovation, which is Porter’s ‘differentiation’ and Cohen and Roussel’s ‘innovation’ strategy. These strategies deal with higher margins, less price-sensitive consumers and innovative products that cause a strong consumer pull.

Cohen and Roussel (2005) further differentiate the business strategy of ‘service’, which focuses on customers’ needs and superior customer service to achieve customer loyalty. Furthermore, they define the strategy of ‘quality’ concerning products with a premium nature that have a consistent and reliable performance. According to Roh, Hong & Park (2008), there is also the competitive strategy of flexibility that requires adaptation in an

uncertain environment. Finally, Porter (2008) defines the competitive strategy called ‘focus’, which means for a company to concentrate on a particular segment of the product line, geographic market or buyer group to achieve better differentiation and/ or lower costs by focusing on a particular target. Focus can be used with any of the five strategies mentioned above.

Porter (2008) argues that the three generic strategies can be used either solely or combined while Cohen and Roussel (2005) recommend focusing only on one competitive aspect, which should be driven to perfection. However, they mention also to pay attention to the remaining strategies. Therefore it can be concluded that for each product should exist a focus on one or a combination of strategies depending on the market environment, but certainly all strategies should be considered in some way. The next chapters will give information about the important aspects of supply chain management.

3. SUPPLY CHAIN MANAGEMENT AND SUPPLY CHAIN STRATEGY

The third chapter deals with supply chain management and supply chain strategy. Thus, supply chain management will be defined first. Then supply chain functions, supply chain strategies and the five configuration components for the supply chain strategy will be explained. Finally follows the consolidation of the different SC strategies. For this topic, Cohen and Roussel's book about *Strategic supply chain management* (2005) was the main literature base. Furthermore, a number of articles and websites have been used to broaden the view.

3.1 Defining supply chain management

The term 'supply chain management' (SCM) was first used by consultants in the 1980s. Some researchers see it as the unit that is responsible for developing and maintaining a competitive advantage (Rose et al. 2012: 6). There are various definitions for supply chain management, but most of them focus on similar issues. In the following part, some important definitions will be compared to each other. The Council of Supply Chain Management Professionals (CSCMP) in the United States (2012) defines SCM as "the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities." Moreover, according to the definition, SCM encompasses coordination and collaboration with channel partners who consist of customers, suppliers, intermediaries, and other mediators who provide service. In summary, SCM has the task of coordinating supply and demand management within and across countries (CSCMP 2012). The Ohio State University Global Supply Chain Forum' s definition is often used as the norm: "SCM is the integration of key business processes from end user through original suppliers that provides products, services and information that add value for customers and other stakeholders." (Lambert, Cooper & Pagh 1998). To put it simply, SCM is the management of multiple relationships and the flow of goods and services (Lambert et al. 1998: 1).

SCM has an integrating function and is foremost responsible for managing the interfaces of the key business functions and processes within and across firms into a connected and well-functioning business model (CSCMP 2012). The ultimate goal of an effective SCM is said to be the reduction of inventory while the availability of products is ensured when demand arises. Furthermore, SCM can be divided into three kinds of flows: the product flow, the information flow and the financial flow. The product flow consists of sourcing goods, moving them from supplier to customer plus caring for any customer returns or service needs. The information flow involves sending orders and updates on the delivery status. Finally, "the financial flow consists of credit terms, payment schedules, and consignment and title ownership arrangements" (Rouse 2010).

Market developments, which are caused by globalization and outsourcing, lead to challenges for SCM. These challenges encompass an increase of competition, demand variability, product variety, customization and shortened product life cycles (Hilletofth 2009: 16 – 17). This is why every product or market needs a tailored supply chain strategy for its supply, operation and distribution parts, as there does not exist one standardized solution. Next will follow the explanation of supply chain functions.

3.2 Supply chain functions

The five main supply chain functions are to plan, source, make, deliver and return (Sillanpää & Sillanpää 2014: 101). Planning concerns the collection of information in order to facilitate decision-making. Sourcing means procuring raw materials. Making is defined as converting a good into a finished condition to fulfill planned or actual demand. Delivering is bringing the finished products to the customer. Returning refers to the processes related to returning or receiving handed back products and the handling of complaints (Iskanius 2006). These functions offer a company opportunities for optimization like planning, the possibilities to create competitive advantages and the reduction of cost and networking capital. At the same time these functions also give a company the chance to create differentiators (Sehgal 2009). In the following part, the five main supply chain functions, listed in the order of plan, source, make, deliver and

return with their important features and their best practices are explained in more detail. The functions of planning and returning concern all other functions, as visualized in the following figure (figure 6).

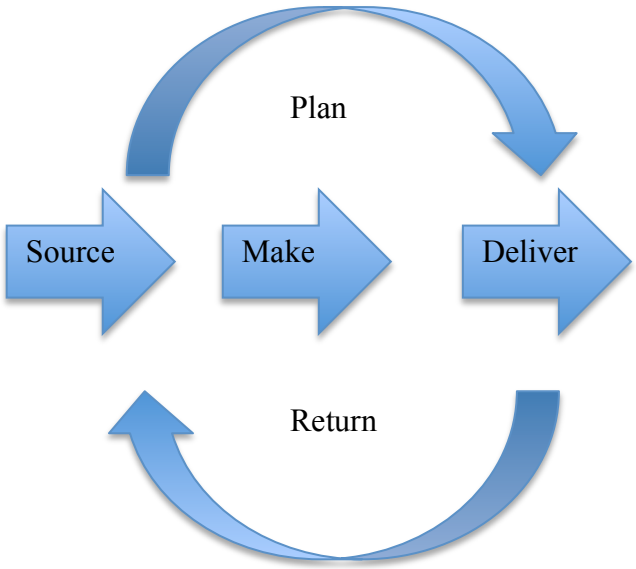

Figure 6: The five supply chain functions.

For the planning process a good forecast is the key factor. The usage of accurate and timely information is important. Furthermore, planning should aim for simplicity and a balance between the goals of sales and finance department. Overall an integration of all departments is important for a good planning process. Finally, the creation of explicit accountabilities and actions is critical (Cohen & Roussel 2005: 78 – 79).

An important element in the stage of sourcing is aiming for the lowest total cost of ownership by considering both direct and indirect costs involved. Furthermore, procurement strategies should be set according to "supply-market complexities and business impacts" (Cohen & Roussel 2005: 81). Next, an enterprise-wide point of view along with the management and measurement of performance are important (Cohen & Roussel 2005: 81).

In the stage of making, the focus should be on business priorities. The objective of this function can be speed and flexibility, not only a focus on low cost. Furthermore, quality standards should be set and controlled and all manufacturing activities should be synchronized (Cohen & Roussel 2005: 83).

For the process of delivering, the balance of service with the cost of serving is critical. Next, costs and time can be reduced with straight-through processing. This means that simultaneous execution can take place by making order information constantly accessible to all involved departments. Furthermore, end-to-end tracking and traceability should be established. Finally, data should be constantly and accurately updated (Cohen & Roussel 2005: 85).

Return can be seen as a reverse supply chain process and usually deals with small volumes of many different components in varying frequency. It is important to establish a distinct supply chain for return. Moreover, there should be timely feedback on return. Next, return policies should be adapted to the total costs of the return. Finally, the revenue opportunities should be maximized through disposal paths that can generate revenue (Cohen & Roussel 2005: 87 – 88). It is important to mention that complaint management is an essential tool for customer retention. Next follows the introduction of different supply chain strategies.

3.3 Supply chain strategies

Chopra and Meindl (2007) developed a framework that states that supply chain management seeks for a balance between efficiency (cost-leadership) and responsiveness (differentiation). In order to achieve this objective a firm must select the right mix of the three logistical (facilities, inventory and transportation) and three cross-functional drivers (information, sourcing and pricing). Other theories differentiate between ‘efficient’ relating to costs and productivity (lean) or ‘responsive’ (agile) supply chains, e.g. Morash (2001) differs between operational excellence (lean) and customer closeness (agile).

3.3.1 Lean, agile and leagile SCs

On the one hand, lean supply chains aim for smooth, forecast-driven operations while minimizing waste from production to delivery. This idea stems from Toyota's lean production that became popular in the 1980s and 1990s. Toyota defined 'waste' in its production system as "1) defects in production, 2) overproduction, 3) inventories, 4) unnecessary processing, 5) unnecessary movement of people, 6) unnecessary transport of goods, and 7) waiting by employees and 8) goods and services that fail to meet the needs of customers" (Goldsby et al. 2006: 58 – 59). Waste can be minimized by the elimination of paperwork, by the reduction of inventories, lot-size or supplier base, by evaluating suppliers according to quality and delivery performance or by establishing long-term relationships with suppliers (de Treville, Shapiro & Hameri 2004). Basically it is all about the elimination of non-value-added processes (Kumar B.R., Agarwal & Sharma 2016: 313). However, Perez (2013: 5) claims that Toyota's strategy was actually a mix between agile and efficient models. Therefore, he states "an efficient model uses a 'make to forecast' order penetration point, Toyota Production System uses an 'Assembly to order' order penetration point". Yet he admits that the both models have a cost-minimizing goal, which might lead to the confusion. Yet most other researchers see Toyota's model as the first lean one and consequently it will be considered as such in this thesis as well.

Furthermore, a lean SC is a strategy for functional products according to Fisher (1997). He divides products into functional and innovative ones, while the former should be supplied with (cost-) efficient SCs in contrast to the latter, which requires responsive SCs. Moreover, a lean SC requires high production efficiency. Thus, using this strategy encompasses building a separated production line for each product and avoiding exchanges of products, which usually leads to high utilization (Sillanpää & Sillanpää 2014: 103). Furthermore, a lean SC uses economies of scale for production processes and inexpensive models for transportation (Balasescu & Balasescu 2014: 13).

On the other hand, agile, demand-driven supply chains are constructed to react to unpredictable situations and profits from these kind of situations by providing fast delivery and having flexible manufacturing systems for short lead times. The objective

of agile SCs is to match demand and supply in unpredictable markets. They strongly focus on understanding and meeting customer needs. Therefore, the risk lies in failing to meet customer demand. By using information systems and technologies this SC strategy can process information quickly and make improved decisions (Sillanpää & Sillanpää 2014: 103 – 104). It is a strategy for innovative products (Fisher 1997) that came up under turbulent market conditions in the 1990s (Mason-Jones, Naylor & Towill 2000a).

The best application of an agile SC is reached with achieving a strategic optimum. The strategic optimum area represents increased uncertainty of the competitive strategy to which the supply chain strategy reacts with a growing responsiveness (agility) (see figure 7). Achieving a strategic optimum is possible when serving only one market segment, but difficult to obtain when serving several market segments. To achieve a strategic optimum, the distribution responsiveness and the supply and demand default must find a common point. To be more exact, a firm must construct a logistic channel that best serves the requirements of different consumer segments. Moreover, with a changing competitive environment, a company must adapt its competitive strategy and logistic strategy to maintain a strategic optimum (Balasescu & Balasescu 2014: 15). The reason is that in general globalization leads to the development of an increasing variety of products, a higher price pressure on companies and an increasing variability of demand. Furthermore, companies have to deal with handling an increasing amount of supply opportunities to decrease response time and to control prices (Balasescu & Balasescu 2014: 15).

Finally, a hybrid version, the so-called leagile supply chain is also an option. The advantages of leagile supply chains are the ability of customization, even ‘mass-customization’ due to a higher level of variety at lower costs when customizing locally, less inventory and obsolescence costs, higher flexibility and facilitated forecasting abilities. An important prerequisite for this strategy is a reliable supplier network (Hilletofth 2009: 21 – 22).

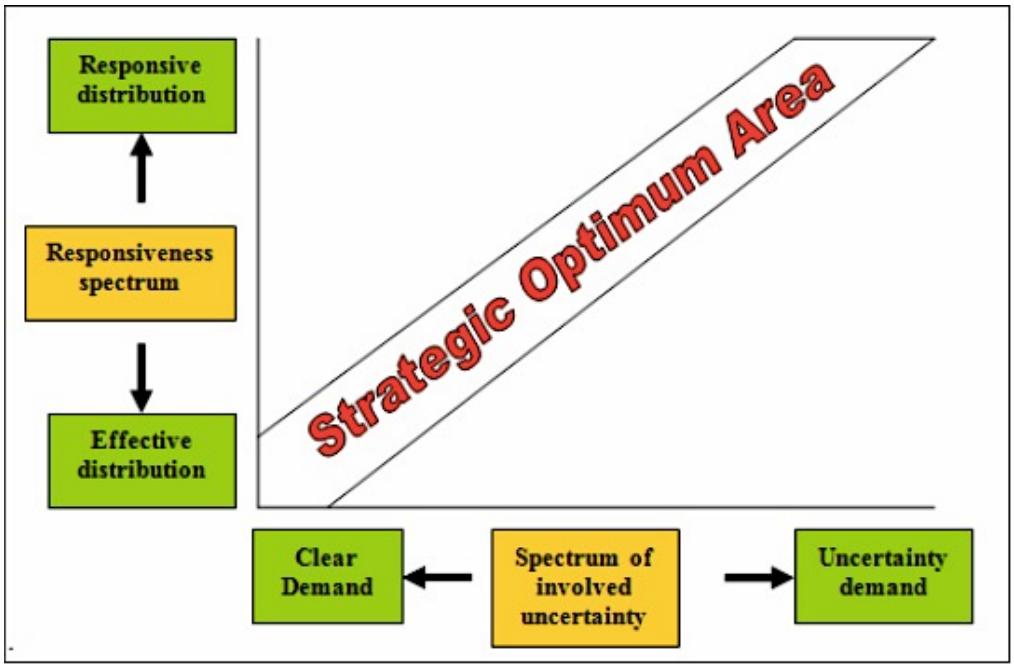

Figure 7: The relationship inside the Strategic Optimum Area (Balasescu & Balasescu 2014: 14).

Three distinct leagile supply chains can be differentiated. The first one is based on the Pareto rule, claiming that 80% of the firm's revenue is gained by 20% of the firm's products. This would mean that these dominating 20% of the product assortment should be managed in a lean supply chain (Goldsby et al., 2006) while the other 80% are managed in an agile manner (or depending on the company these 80% should be further examined to determine which management strategy suits best). The second hybrid is based on the idea of a base demand that should be managed in a lean manner while surplus demand in form of demand peaks due to seasons or promotions can be managed in an agile manner (Goldsby et al. 2006). The third version is based on the idea that risk and uncertainty costs are caused by differentiation. In this version exists a decoupling or order penetration point. Upstream of this order penetration point, the supply chain follows lean principles as long as production is according to schedule. Downstream of the order penetration point the supply chain follows an agile principle responding to customer demand. By postponing activities or by moving the customer order point upstream in the supply chain until demand is there, risk can be lowered. Another name for this strategy is postponement strategy as customization is delayed in order to react

quickly to a changing market demand (Sillanpää & Sillanpää 2014: 104 – 105). Postponement can take place in form of delaying assembly (Assembly-To-Order, also called Configure-To -Order), production (Make-To-Order), sourcing (Sourcing-To-Order) or design (Engineer-To-Order). In the following paragraph SC classification models are introduced.

3.3.2 SC classification models

Christopher et al. (2006) developed a classification model with three parameters, which are type of products (standard or special), type of demand (stable or volatile) and replenishment lead-times (short or long). On the one hand a specialized product is characterized by low volume, volatile demand, a short life cycle and high customization. On the other hand a standardized product has the characteristics of a more stable demand, a longer life cycle and non-existing or a limited level of customization. The following matrix (figure 8) suggests four generic supply chain strategies using the dimensions of replenishment lead-time and predictability. Replenishment lead-time influences responsiveness and predictability that is in close relation to the product type. The first SC has predictable demand and short replenishment lead times leading to a lean (continuous replenishment) strategy. Secondly, the opposite situation that has an unpredictable demand and long replenishment lead times requires a leagile SC strategy. Thirdly, long lead times and a predictable demand, lead to a lean SC strategy, e.g. make and source before demand. Fourthly, unpredictable demand and short lead times result in an agile SC strategy representing rapid response. Furthermore, Christopher et al. (2006) claim that each cell of the model can be adapted to a standardized or a specialized product. For example, postponement for a specialized product refers to manufacturing while for standardized products it refers to distribution.

Perez (2013) developed the following generic supply chain models: efficient, fast, continuous replenishment, agile, leagile and flexible supply chain. Furthermore, Lee (2002) developed a demand and supply uncertainty framework that concerns four types of SCS: efficient, risk-hedging, responsive and agile. In the following part, Lee's

framework will be presented and Perez' model, especially flexible, fast and continuous replenishment strategies will be compared to it.

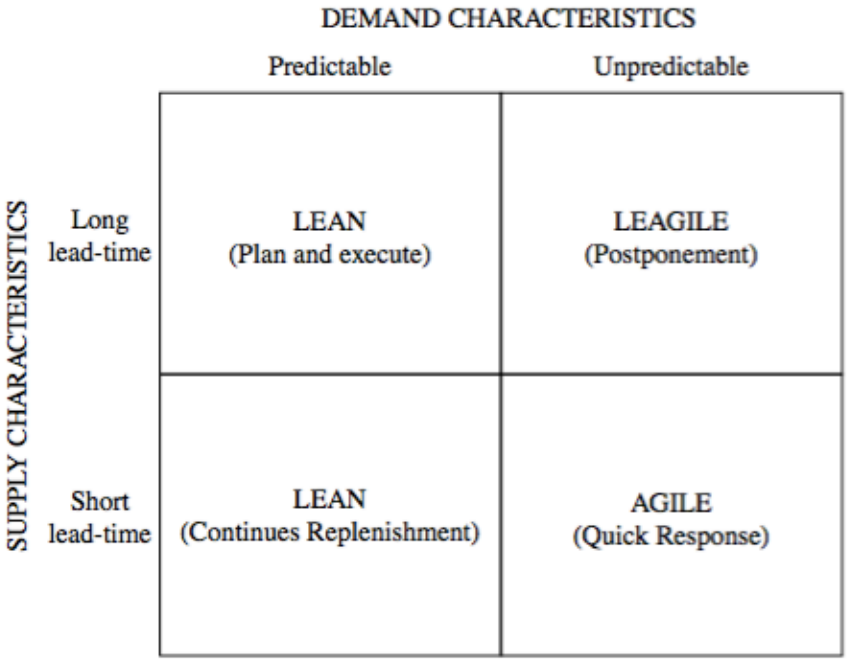

Figure 8: How demand/ SC characteristics determine SC strategy selection (Christopher et al. 2006).

Both Lee and Perez introduce efficient supply chains (ESC) that have according to Lee (2002) features like lean supply chains, which are usually used in mature markets. The competitive advantage is mainly achieved through low cost and economy of scale. Efficient supply chains are used for the efficient production of quality products (Lee 2002). Uncertainties are generally low as it is characterized by regulations and standardization. Its characteristics are total cost reduction along with reliability and supply efficiency. This means that a firm following a cost leadership strategy constantly searches for opportunities to minimize costs and erase intermediate production steps. Suppliers are selected based on costs of reliability and ease of doing business while operations and logistic systems strive for efficiency and a zero defect rate (Gupta, Gollakota & Srinivasan 2009: 88). Perez characterizes efficient supply chains for highly

competitive markets and for long life cycle products with predictable demand. Furthermore, they have a high asset utilization rate and a customer orientation towards low costs. However, the researcher does not see lean and efficient SCs as one category and emphasizes that they only share the goal of cost minimization. (Perez 2013: 5).

Next, risk-hedging supply chains (RHSC) are used under uncertain conditions for the supply while the demand is predictable and stable. This SC is used in the retail industry and dealerships. Examples of companies using this SC are hydroelectric power companies and a number of food producers. Supply uncertainties are leveraged by keeping stock of core products or components while trying to share the costs for stocking with other firms by pooling and sharing resources. ESC and RHSC are both used for functional products (Lee 2002).

Perez (2013: 7) identifies capacity and inventory pooling for the ‘flexible SC’ as well. Additionally, he finds outsourced capacity for this kind of SC, “which is supported in sharing information of capacity and inventory with suppliers, customers and inclusive, competitors“ (Perez 2013: 7). Furthermore, the ‘flexible SC’ is customer-oriented and deals with disruptive supply and unpredictable customer demand. Thus, it seems to be more like an agile SC. As an example Perez lists “companies oriented to corrective maintenance as flood control, in which own equipment could be insufficient and companies must share equipment with suppliers, customers or inclusive competitors“ (2013: 7).

Next, a responsive supply chain (RSC) exists when a company offers various products that are of high quality and performance and that aim for scope economies, which is often performed through product innovation and improvement. In this supply chain the production of the final form of the product is postponed as long as possible due to uncertain demand conditions e.g. in the fashion apparel, computers and pop music industries (Lee 2002). This is comparable to what is described above as one of the forms of a leagile SC, the so-called postponement strategy, which uses an order penetration point (Sillanpää & Sillanpää 2014: 104 – 105). The features of a RSC are a high level of value-added customer service, proactive ensuring of quality and a

collaborative relationship with the customer. The aim of improving customer satisfaction is constantly pursued by trying to add value to the value chain. One part of this kind of SC is vendor-managed inventory (VMI)/ supplier-managed inventory meaning when the supplier cares for the inventory replenishment process of the customer (Waller, Johnson & Davis 1999: 183). The ultimate goal is to go from customer service to customer satisfaction to customer success and become part of the customer organization by providing high levels of help, support and interactive advice (Gupta et al. 2009: 89).

Perez calls the RSC 'fast supply chain' due to the fast "concept to production process" (2013: 5) that is required to react quickly to the fast changes in customer demand. He further distinguishes the 'continuous replenishment SC', which is characterized by "predictable and stable demands, long life cycle products, low supply disruption risk, low market mediation cost, and principally customers oriented to process efficiency, especially low working capital" (2013: 6). Thus, Perez sees supplier-managed inventory as a new category of SC strategies instead of as a sub-category of responsive SCs.

Finally, the both Perez and Lee define the agile supply chain (ASC). Lee sees it as the most market-oriented and flexible SC because it has to deal with uncertain demand and supply conditions. Thus, it requires fast adjustment to volatile conditions, e.g. in high-end computer and semiconductor industries. RSC and ASC are both used for innovative products. To respond to these pre-conditions, this SC provides a variety of products with high quality, high performance and high customer service. Furthermore, the company hedges supplier risk by creating opportunities for flexibility with this SC (Lee, 2002).

Perez sees products made for postponed design and extra production capacities as the two main characteristics of the agile SC. The agile SC is for short life cycle products and generally to fulfill unpredictable demand quickly (Perez 2013: 6). Additionally, Perez defines the 'LeAgile SC' dealing with unpredictable demand that has to be fulfilled fast in a strongly competitive market with a medium risk of disruption. It is used to manufacture long life cycle products. According to the researcher it is "the most

demanding model, because it requires agility with low cost" (Perez 2013: 6). It is used in apparel, computers and automobile industries. Table 2 summarizes the characteristics of all four types of Lee's supply chains. In the next paragraph the five SC configuration components are defined.

3.4 Five configuration components for the supply chain strategy

A firm cannot follow a one-size-fits-all strategy, but has to select a specific strategy. According to Cohen & Roussel there are five critical configuration components for a company's supply chain strategy, which are operations strategy, outsourcing strategy, channel strategy, customer service strategy and asset network. These strategies will be explained further in the following.

There are four kinds of operation strategies. First, *make to stock* is used for standardized products that sell in big quantities. This strategy helps lowering manufacturing costs and keeps inventory levels of stock to fulfill customer demand quickly. Secondly, *make to order is* for customized products or products that are infrequently demanded. It allows low inventory and higher service levels. Thirdly, *configure to order* is for products that are completed at a generic level and completely finished when obtaining a customer order, as there are many modifications of the final product. This strategy allows low levels of inventory, many different kinds of product variations and simpler planning. Finally, *engineer to order* is a similar strategy like 'make to order' for industries producing complex products and services according to particular customer demand. Adjusting the operations strategy can lead to advantages such as decreasing inventory and improving service (Cohen & Roussel 2005: 11 – 12).

Table 2: Characteristics of supply chain strategies (Roh, Hong & Park 2008, adapted from Lee 2002 and Vonderembsee, Uppal Huang & Dismukes 2006).

Category	Efficient supply chain (ESC)	Risk-hedging supply chain (RHSC)	Responsive supply chain (RSC)	Agile supply chain (ASC)
Supply uncertainty	Low	High	Low	High
Demand uncertainty	Low	Low	High	High
Definition	A ESC aims at achieving the highest cost efficiencies in the supply chain through the elimination of waste or non-value-added process	A RHSC aims at sharing risks in supply disruption through pooling and sharing resources	A RSC aims at being rapidly adaptive to the change of customer needs and market volatility	An ASC aims at being responsive and context-specific to customer needs, while the risks of supply shortages or disruptions are hedged by pooling inventory or other capacity resources
Focus	Highest cost efficiencies in the supply chain	Cost efficiency and hedging the risk of supplier disruptions	Adaptability to rapidly changing customer needs	Be market-oriented and have capacity to meet a wide variety of market niches simultaneously
Product type	Functional	Functional	Innovative	Innovative
Competitive priorities	Cost and quality	Cost, flexibility, quality	Speed, flexibility	Speed, flexibility, innovation
Supply uncertainty	Low	High	Low	High
Demand uncertainty	Low	Low	High	High
Supplier relationship	Transaction-based	Relation-based	Time-based	Partnership-based

Sources: Adapted from Lee (2002) and Vonderembse *et al.* (2006)

Outsourcing strategy concerns operations that are better, faster or cheaper performed by a third party. In contrast to that, the company's core competence should be kept in-house and should be constantly improved. Therefore it is necessary to consider a company's source of differentiation, the operating scale, the uniqueness of operations and the power position. Outsourcing gives companies the opportunity to ramp up or down fast, create new products, reposition themselves, and most importantly to concentrate on their core advantages and competitive position (Cohen & Roussel 2005: 15). External partners can provide three advantages. First, they can provide scale advantages as they serve a high amount of customers, leading to high utilization and low unit costs. Secondly, there is the advantage of scope, which attracts companies that want to expand geographically and to new target markets. Finally, there is technology expertise, which allows a company to use an outsourcing partner's process or product technology that would normally require a high internal investment (Cohen & Roussel 2005: 15 –16).

Channel strategy concerns how products and services reach buyers and end users. It refers to indirect sales through retailers or distributors or direct sales through the Internet or a direct sales force (Cohen & Roussel 2005: 13 – 14).

Customer service strategy has two main fields. One is the complete volume and profitability of a company's customer accounts and the other one concerns the knowledge of customer's needs (Cohen & Roussel 2005: 17).

Asset network refers to a company's factories, warehouses, order desks, production equipment and service centers. There are three main network models that differentiate by the criteria of "business size, customer service requirements, tax advantages, supplier base, local content rules, and labor costs" (Cohen & Roussel 2005: 18). First, there is the *global model,* which is the manufacturing of a product line in one location for the worldwide market. Influencing factors for this model are collocation of manufacturing and R&D, the control of unit manufacturing costs for capital-intensive products or highly specialized manufacturing expertise. Next, the *regional model* concerns manufacturing primarily in the locations where the products are sold while some cross-

regional flows might exist as well. Finally, the *country model* concerns manufacturing foremost in the country where the market exists. It refers to products, which cause high transportation costs, and other factors like duties and tariffs (Cohen & Roussel 2005: 18 – 19).

In conclusion supply chains should be customized according to a firm's unique circumstances. Thus, variables like "product characteristics (Fisher 1997), context and integrative practices (Ho et al. 2002), product life-cycle stage (Childerhouse et al. 2002), and contractual issues such as cost distribution and terms (Peleg et al., 2002)" (Rose 2012: 10) influence the SC configuration. Furthermore, the supply chain management should be adaptive as a competitive advantage is limited time-wise by the constantly changing market conditions. Moreover, SCM should be aligned with a company's customer needs, power position, and business strategy (Cohen & Roussel 2005: 20). This thesis focuses on the alignment with the business strategy by questioning the other two forms of alignment with customer's needs and power position as well. The knowledge of the five configuration components influences the creation of the questionnaire (Appendix), which is created in order to examine SCM and the relationship of business strategy and SC.

3.5 Consolidation of supply chain strategies

In the following part the previously explained supply chain strategies will be consolidated. The broad differentiation of supply chain strategies is between **costs and productivity (lean)**, **responsiveness (agile)** or **the hybrid leagile supply chains** e.g. Chopra and Meindl (2007) differ between efficiency (cost-leadership) and responsiveness (differentiation) and Morash (2001) differs between operational excellence (lean) and customer closeness (agile). Lean or efficient supply chains are characterized by the aim of eliminating waste and reducing costs in forecast-driven operations with predictable demand. The competitive advantage is achieved by the principle of economies of scale. Agile or responsive supply chains are supply chains for short lead times that exist in order to react flexibly to unpredictable situations. Their

main objective is to provide superior customer service. Leagile supply chains are for situations of unpredictable demand and long replenishment lead times.

Lee (2002) developed a demand and supply uncertainty framework leading to four types of SCs which are efficient, risk-hedging, responsive, and agile supply chains. Lee's efficient supply chain also includes a high basic customer service whereas according to other theories, efficient supply chains focus just on cost reduction. Moreover, Lee adds the **risk-hedging supply chain**, which is used under uncertain supply, but stable demand conditions. The distinguishing aspect of this SC is that by using stock, uncertainties are leveraged. Furthermore Lee differentiates between responsive and agile supply chains, as the latter has to react even more flexibly due to both uncertain supply and demand conditions and simultaneously provide high quality, high performance and high customer service. Yet as the RSC has similar characteristics to the leagile SC, they will be seen as one category. Risk management will be examined separately as explained in the next paragraph.

Perez (2013) developed the generic supply chain models of efficient, fast, continuous replenishment, agile, leagile and flexible supply chain. Efficient, agile and leagile SCs are similar to the SCs found by other researchers. Although Perez claims that efficient and leans supply chains are different kinds of SCs, no other researcher confirms this claim. After all, they both strive for cost minimization. Next, the 'flexible SC' seems to be a mix of Lee's 'risk-hedging' and 'agile SC'. Moreover, the 'fast SC' seems comparable to Lee's ' 'responsive SC'. Furthermore, Perez is the only author identifying a specific 'continuous replenishment SC'. Thus, the focus will be on three SCs that can be well distinguished from each other and are found by the majority of researchers: **lean/ productive/ efficient** vs. **agile/ responsive/ flexible/ fast** vs. **leagile supply chain.** The other kinds of SCs, especially 'fast' and 'continuous replenishment SC' will be kept in mind as potential sub-categories that could be further examined in the empirical part.

The most coherent results concern agile SCs. Agile supply chains represent differentiation, responsiveness or customization. Customization and responsiveness can

be interpreted as factors that go along with each other. Risk-hedging SCs are to an extent similar to agile supply chain, but more focused on managing difficulties with suppliers. The question of hedging risk through the SC will be examined further. Next, lean supply chains emphasize an approach cost-minimization or operational excellence. While more studies emphasize the cost-minimization approach, Morash (2001) focuses on operational excellence. Here, the empirical part in chapter six should give further input about the possible existence of a different kind of supply chain that focuses on operational superiority.

4. ALIGNMENT OF BUSINESS STRATEGY AND SUPPLY CHAIN MANAGEMENT AND STRATEGY

The following chapter discusses the alignment of business strategy and supply chain management/ strategy. It starts with an overview of existing studies concerning this topic. Then the advantages of alignment are explained. Next, the theoretical view of alignment is presented. Finally, the summary in form of a theoretical framework is presented. Additionally to the books of Porter and Cohen and Roussel, a number of articles concerning the alignment of business strategy and supply chain management from important databases in the business field, which are mainly Ebsco, Emerald Insight and Sage Journals, are used. This literature also allows developing a questionnaire to use in the interviews. In summary this choice of literature should offer a comprehensive insight into the topic to construct a theoretical framework, which then is compared with the interview results in the empirical part.

4.1 Existing studies of supply chain alignment

The following part should give a short overview about existing studies concerning the alignment of business and supply chain strategy. The most important results are summarized in a final table. Generally, Japanese companies succeeded in competing with Western companies in the 1980s by simultaneously decreasing costs and improving differentiation. Thus, they succeeded in overcoming the assumed trade-off between costs and defects (Porter 1996: 6). The idea of lean supply chains stems originally from Toyota in its production of high-quality, affordable automobiles. It is based on the objective of Kiichiro Toyoda who was the first president of Toyota Motor Corporation “to use small lot size with cheaper vehicles to compete with the cost of American motor companies by continuously reducing cost through waste elimination“. The second president, Eiji Toyoda, improved Toyota’s manufacturing process further. In the 1950s the company adapted Henry Ford’s concepts of “continuous material flow, process standardization and waste elimination” and other strategic ideas used by American retailers. Thus, Japan’s auto manufacturer achieved “low cost manufacturing

with smaller volume and higher complexity and shorter lead times“ (Wee & Wu 2009).

Next, Hewlett-Packard (HP) originally pursued an innovation-based strategy, but the competition with Lexmark forced it to implement a low cost, lean strategy. In 1997 Lexmark launched a printer for less than 100 dollars and doubled its market share till the middle of the 1990s. Thus, HP decided to pursue a strategy of reducing product costs by changing design and supply in order to directly compete on costs with Lexmark (Cohen & Roussel 2005: 23). Furthermore, Boeing continues to pursue a lean approach due to the airline industry's demand for cost-efficient solutions and the request to deliver profitable growth. Significant changes occurred in this industry between the 1990s and 2000s when a lot of airline companies went into bankruptcy or conducted mergers and acquisitions while low-costs carriers grew rapidly. Boeing is working on reducing its supply base for more efficiency and involving more risk-sharing suppliers. Furthermore, it implements lean manufacturing techniques internally and externally with its suppliers. As changes continuously take place in the airline industry, the implementation of lean strategies will also play a significant role in the future (Cohen & Roussel 2005: 33). Newer studies focus on the topic of sustainability of the SC. Thus, a study by Kumar B.R., Agarwal and Sharma (2016) examines lean strategies in the aviation industry in order to implement waste minimization techniques.

Next, Balasescu and Balasescu (2014) find an efficient supply chain for Barilla. Pasta is a product with a quite stable demand, which allows the usage of an efficient supply chain. Lean supply chains suit commodities, which are basic products such as pasta. These products “have relatively long life cycles and have low demand uncertainty due to the fact that they tend to be well-established products with a known consumption pattern” (Mason-Jones, Naylor & Towill 2000b: 4063). Therefore cost reduction is the main consideration regarding basic products (Mason-Jones et al. 2000b: 4063).

The U.S. Department of Defense, which is simultaneously the largest supply chain in the world, uses an agile supply chain. The reason is that the customer in this case is “a ‘warfighter’. And he or she is liable to be anywhere, anytime these days” (Cohen & Roussel 2005: 170). Furthermore, after being researched, Dell as a company was found

to use agile supply chains in order to react flexibly to changing demands, which is the reason this computer maker holds an inventory of component parts. Furthermore, lots of its suppliers are located near its assembly plants and thus are able to provide parts just-in-time. This enables Dell to follow a make-to-order (or better assembly-to-order approach) according to customer-specific wishes. The company provides customers with exactly the configuration they wish for. Yet in this process, clients have a slightly higher waiting period until their products are delivered as opposed to the make-to-stock approach. Dell and other agile firms count on customers' preference of waiting in order to obtain customized products in contrast to standardized ones (Rose et al. 2012: 19). Dell is one of the model companies that successfully implemented a generally called build-to-order-approach and thus achieved a significant competitive advantage. Yet managing an entire build-to-order SC is extremely challenging and due to this reason research and practice in this field are still limited (Gunasekaran 2005).

Balasescu and Balasescu (2014) examined medium-to-large-sized companies like Dell, Ikea and Barilla. They also found a responsive SC for Dell. Furthermore, according to them, Ikea has a responsive supply chain in the distribution channel. Thus, Ikea keeps a range of inventory at the stores and additionally serves its customers from warehouses (Balasescu and Balasescu 2014: 14). Another example of an agile supply chain can be encountered at TaylorMade adidas Golf (TMaG), which produces high-performance customer-specific golf clubs. The company follows a similar approach like Dell by following a make-to-order approach to fulfill customer-specific demand (Goldsby, Griffis & Roath 2006: 61).

Next, Sillanpää and Sillanpää (2014: 109 – 111) conducted an empirical case study with global engineering businesses in Europe and Asia. Both companies try to use a corporate differentiation strategy along with an agile and responsive supply chain framework due to unpredictable demand, a low product volume and a dynamic business environment (compare figure 9 - supply chain strategy framework). They find the difference between Europe and Asia in forecasting. In the European supply chain forecasting is conducted with customers while in the Asian SC forecasting is conducted independently. Furthermore, the authors conclude that "there are significant differences

comparing supply chain strategies in Europe and Asia" (Sillanpää and Sillanpää (2014: 110), which are unfortunately not explained any further.

Another case study examines the Swedish food retailer sector regarding its meat, dairy fruits, vegetable, bread, and beverage sectors. These retailers cover together almost 80% of the total food retail market in Sweden (Abrahamsson & Rehme 2010: 17). The study's results are that a more dynamic, competitive and internationalized business environment with fast changes in demand leads to a higher importance of "cost effective, flexible and adaptive logistic platforms and more adaptive and agile supply chains" (Abrahamsson & Rehme 2010: 21). Next, Seven-Eleven Japan designed its supply chain for agility in order to respond fast to changes in demand by using real-time systems that track data concerning changes in customer preferences, sales and consumers at each store (Lee 2009: 112). Furthermore, Sony, Nike, and L'Oréal need to be fast to market with new products that buyers want, and therefore have to integrate the supply chain with the design chain (Cohen & Roussel 2005: 24), which in turn requires an agile supply chain.

Seagate Innovation is a technology leader with the objective to bring innovative products to market quickly, integrate speed and flexibility into the company and maintain a focus on customer satisfaction. To fulfill its customer demand in real time, it follows a flexible approach while maintaining low levels of inventory (Cohen & Roussel 2005: 251).

H&M, Mango and Zara integrated agility in every part of their supply chains, which allowed them to become Europe's most profitable apparel brands. They have agile design processes on the one hand and super-efficient distribution centers on the other hand (Lee 2009: 106). In general fashion products have a short life cycle and high demand uncertainty. Especially for trendy clothing an agile strategy that matches supply and demand and allows quick responses is preferred (Mason-Jones et al. 2000b: 4063). However, Zara also has activities like cutting, dying, labeling, and packaging in-house in order to achieve economies of scale, leading to the conclusion that it uses a leagile SC (Myerson 2014).

Other kinds of SC strategies were found with the following companies. Avon is the only discussed company with a focus strategy. This firm uses a flexible SC (Cohen & Roussel 2005: 100) that is country-focused (Cohen & Roussel 2005: 99). Competing on quality goes for Lexus automobiles, Maytag appliances, Tropicana juices and Barlean's Organic Oils (Cohen & Roussel 2005: 25). For example Barlean's oil differs from the competition by offering freshness. This high level of freshness is achieved by manufacturing and distribution processes, which allow make-to-order manufacturing and use express mail shipment. Next, Shell Chemical focuses on competing on service (Cohen & Roussel 2005: 26). Therefore, it offers an inventory management solution to its manufacturing customers that has the benefits of facilitating the purchasing process and cutting SC costs. The customers connect their IT systems with Shell's system and profit from this service by receiving an enhanced inventory management system with decreased stock and without the need to place orders separately.

Leagile SCs were researched in the following companies. One study is a multiple case study approach with cases from Sweden, which are significantly internationalized (Hilletofth 2009: 16). The cases encompass a Swedish manufacturer operating internationally in the enterprise telecommunications industry with lean and agile SCs for different products (Hilletofth 2009: 24 – 25). This case study is strengthened with another one of a Swedish manufacturer operating internationally in the white goods industry (Hilletofth 2009: 17 – 18). Both case companies developed differentiated SC strategies. Yet the researchers state: "Very little research work has addressed the need to employ several SC solutions concurrently, and how to develop and manage these multiple SCs" (Hilletofth 2009: 30).

Gap also uses a leagile strategy. It owns the Old Navy brand that targets cost-conscious customers, the Gap line for trendy consumers and the Banana Republic brand that represents high quality apparel. Thus, Gap conducts Old Navy's manufacturing and sourcing in China for cost-efficiency. The Gap brand's SC is set up in Central America for speed and flexibility and Banana Republic's SC in Italy to produce high quality products (Lee 2009: 109).

For the carpet industry a leagile supply chain is reasonable. In this industry an agile SC was found for 10% of the product range, which accounts for 52% of the volume. The other products can be produced using an alternative lean SC that does not provide the same one-week delivery (Mason-Jones et al. 2000b: 4068). Furthermore, Autoeuropa VW in Portugal follows a leagile approach with an emphasis on agile SCs, followed by lean ones. The firm needs agile SCs to stay competitive by responding to constant changes in the market place and customer requirements. Leanness, waste reduction and the resulting cost improvements are implemented when possible but less considerable due to already highly standardized processes (Cabral, Grillo & Cruz-Machado 2011: 4842). These days Toyota also follows a leagile approach. The base vehicle's production is lean and conducted in Japan whereas the agile part of fulfilling customer-specific demand is conducted by port facilities or dealers. This approach is also called forward-positioned postponement (Goldsby et al. 2006: 62 – 63).

In Lithuania Stonkuté (2013) conducted a small- and medium-sized enterprises perspective in a variety of economic sectors (Stonkuté 2013: 116). The results show a focus on quality and lead time as objectives (Stonkuté 2013: 119), which leads to the conclusion of striving for lean or agile supply chains. This conclusion is not very distinct. Yet this study is relevant due to the focus on a specific country, as this thesis also focuses on one specific country, which is Germany. A summary of the existing studies is presented in table 3.

Table 3: Summary of existing studies concerning the alignment of supply chain and business strategy.

Year	Author	Key Contributions
2000b	Mason-Jones et al.	-Lean supply chains suit commodities, cost reduction is the main consideration regarding basic products -Trendy clothing requires agile strategy that matches supply and demand and allows fast responses to demand changes -Carpet industry should use leagile SC

Year	Author	Key Contributions
2005	Cohen and Roussel	-Hewlett-Packard (HP) switches from innovation-based strategy to low cost strategy due to competition with Lexmark -Boeing pursues lean approach due to the airline industry's demand for cost-efficient solutions and the request to deliver profitable growth -Sony, Nike, and L'Oréal need to be fast to market with new products that buyers want, they have to integrate the supply chain with the design chain, consequently they use agile SC -Seagate Innovation, technology leader with the objective to bring innovative products to the market quickly with agile SC -U.S. Department of Defense representing the largest SC worldwide, has agile SC -Competition on quality: Lexus automobiles, Maytag appliances, Tropicana juices and Barlean's Organic Oils -Competition on service: Shell Chemical
2006	Goldsby et al.	-First lean SC by Toyota in 1980s -TaylorMade adidas Golf has agile SC, make-to-order approach to fulfill customer-specific demand
2009	Lee	-H&M, Mango and Zara integrate agility in every part of their supply chains, apparel with short life cycle and high demand uncertainty -Seven-Eleven Japan with agile SC using real-time systems that track data concerning changes in customer preferences, sales and consumers at each store -Gap's leagile SC: Gap, Banana Republic, Old Navy
2009	Hilletofth	-Case studies from Sweden: Both case companies develop differentiated (agile) SC strategies
2010	Abrahamsson and Rehme	-Swedish food retailer sector: more dynamic, competitive and internationalized business environment with fast changes of demand leads to a higher importance of agile SC

Year	Author	Key Contributions
2011	Cabral et al.	-Autoeuropa VW in Portugal uses leagile SC
2012	Rose et al.	-Dell has agile SC; customers' preference of waiting in order to obtain customized products
2013	Stonkuté	-The only study with small- and medium-sized enterprises, conducted in Lithuania
2014	Balasescu and Balasescu	-Barilla has lean/ cost-efficient SC -Dell and Ikea's distribution use agile SC
2014	Sillanpää and Sillanpää	-Empirical case study in Europe and Asia in global engineering business: agile and responsive supply chains due to unpredictable demand
2014	Myerson	-Zara has activities like cutting, dying, labeling, and packaging in-house in order to achieve economies of scale; combined with study from Lee: leagile SC
2016	Kumar, Agarwal & Sharma	-Newer studies regarding sustainability: lean strategies in the aviation industry to implement waste minimization techniques

In conclusion research mostly took place in medium-to-large-sized companies that are often highly internationalized. The industries encompass airline, apparel, household appliances, automobile, carpet industry, chemicals, commodities (especially food and cosmetics), engineering, furniture, golf clubs, military and technology. The countries that were studied are mainly in Asia, Europe and North America. Specific country-based studies were conducted in Lithuania and Sweden. Additionally, a lot of internationally known and American brands were examined. In general the studies are mainly conducted in developed countries or concerning Western brands, which shows that less developed markets are not studied sufficiently yet. It can be concluded that less developed markets first require basic improvements before adjusting SCM and strategy. Therefore results from studies like this one can help companies in less developed countries or markets to reach the next level of optimization.

To confirm previous results, the goal is to conduct research in companies with the same features, meaning medium-to-large-sized companies with a significant degree of internationalization. Moreover, a reason for this choice is that medium-to-large-sized and internationalized companies have clear business strategies and sophisticated SC strategies while smaller businesses often lack those strategies, which might impede research. Furthermore, the thesis is written from an international business student (IBS) perspective and thus companies with an international background were chosen.

In general Qi, Boyer and Zhao (2009) found that companies, which follow either a lean, agile or leagile supply chain strategy outperform those with traditional logistic processes. Next, Lee (2009: 102) claims that companies, which improved the leanness of their supply chains by becoming more efficient and cost-effective, did not achieve a sustainable advantage over their competition, but instead their operation worsened. This is why Galankashi and Helmi (2016: 471) have concluded that an agile supply chain is the consecutive phase of leanness. However, supply chains that are purely lean or agile can rarely be found (Galankashi & Helmi 2016: 471). This again leads to the conclusion that leagile SCs might be the superior solution.

Furthermore, Lee (2009: 104) argues that superior supply chains have three distinctive qualities. First, they are agile. They have the ability to react fast to short-term changes in demand or supply. Secondly, they adapt to structural shifts in markets. Thus, agile SCs include the ability to fast recover from threats like “natural disasters, terrorism, wars, epidemics, and computer viruses” (Lee 2009: 106). One example is Dell, which reacted quickly with price changes over night to influence consumer demand after an earthquake in 1999 delayed the shipment of component parts. Thirdly, agile SCs align the interest of all companies in the supply network so that a company enhances supply chain performance when it maximizes its interests (Lee 2009: 104). Thus the authors conclude that lean efficient supply chains do not possess the ability to react to short-term changes and therefore cannot reach the same profitability as agile supply chains. However, there are cases in which demand can be satisfied with a lean supply chain and a costly agile supply chain is unnecessary (Mason-Jones et al. 2000b: 4063). Consequently, agile supply chains might have a number of advantages over lean supply

chains, but lean SCs might be sufficient to fulfill certain marketplace demand.

These contradicting claims show that further research is required. Thus the subject of aligning business strategy and SC strategy serves as a topic that can be further examined. This research will be conducted with German companies. There have been studies in other European countries, but no study focusing on German companies so far. Moreover, this thesis has the goal to study the alignment of business strategy and SC strategy. The existing studies have more of a static approach examining SC strategies, but not specifically the alignment with changing business needs and therefore with a changing business strategy. The continual alignment of business and SC strategy is a distinguishing factor and might be the reason that authors prefer the agile strategy. Yet a continuous successful alignment between a lean SC strategy with business strategy might have the same benefits. This has to be further examined. Moreover, the study is conducted from an IB student perspective, which gives a fresh view on the topic. In the following chapter the advantages of alignment are presented.

4.2 Advantages of alignment of business strategy and supply chain management

PricewaterhouseCoopers (PwC 2016) claims that firms, which use their supply chains strategically, achieve better business results than the competition, and this is manifested in increased sales growth, profitability and net asset returns. Furthermore, these firms also realize a better supply chain performance. These results show the meaningfulness and impact of the supply chain on the whole company.

When looking at actual companies it becomes evident that a lot of market leaders, e.g. Dell, Walmart, Cisco and Lenovo, which have aligned supply chain management with their business strategy, achieved an increased performance. A survey by PwC in 2013 found that firms that perceive supply chain management as an essential unit of their organization achieve a higher performance by 70%. These firms are called ‘leaders’. Other positive results show that the ‘leaders’ can deliver over 95% on time. Moreover, they have an average inventory turnover of 15.3 (which seems a bit high; a realistic

turnover is e.g. the company Gap's 7.5 times (Porter 1996: 25)) while in contrast without this alignment they achieve only an inventory turnover of 3.8 (Crosdale 2015). If this alignment of SCM and business strategy is lacking (these firms are called 'laggards'), companies only obtain margins on average earnings before interest and taxes of 7.3%, while in contrast the 'leaders' achieve 15.6% (Crosdale 2015). This shows that 'leaders' have not only efficient operations, but also high customer satisfaction. Furthermore, according to Cohen and Roussel (2005: 230), there can be positive correlations between supply chain maturity and superior performance. They claim that companies with mature supply chains have

- a 40% profitability advantage (profitability meaning earnings before interest and tax as a percentage of revenue),
- average total supply chain costs slightly above 8% of revenue while it is usually above 10%,
- a remarkable customer service, with 25% less inventory.

All these studies clearly show the importance of alignment. In the following paragraph the theoretical alignment is described.

4.3 Theoretical alignment of business strategy and supply chain management

In this chapter the alignment of the strategies is discussed. The model above, which compares corporate and business strategy (see figure 2), shows that supply chain strategy is a part of the functional strategies. It is important that the functional strategies are aligned with the business strategies and thus also with the corporate strategy.

According to Porter (1980) and Cohen and Roussel (2005) there are four different business strategies focusing either on cost, innovation, service or quality. Table 4 gives an overview of the most important aspects of each of these four strategies that were mentioned so far and the respectively required supply chain characteristics.

Table 4: Supply chain contribution to business strategy (Cohen & Roussel 2005: 22).

Primary strategy	Source of Advantage	Basis of Competition	Key Supply Chain Contributor
Innovation	Brand and unique technology	Desirable and innovative products	Time to market and time to volume
Cost	Cost-efficient operations	Lowest prices in the product category	Efficient, low-cost infrastructure
Service	Superb service	Tailored to meet customer-specific wishes	Designed "from the customer in"
Quality	Safest, most reliable products	Product you can count on	Supply chain excellence and quality control

Next, the following table (table 5) visualizes critical supply chain practices according to these four primary strategies (Cohen & Roussel 2005: 52).

Table 5: Aligning supply chain practices with the basis of competition (Cohen & Roussel 2005: 52).

Primary strategy	Critical Supply Chain Practices
Innovation	-Design chain/ supply chain integration -Collaborative innovation with suppliers -Dedicated NPI (new product introduction) supply chain
Cost	-Integrated factory planning and scheduling -Raw materials and manufacturing process standardization -Design for manufacturing, procurement, order management
Service	-Customer collaborative planning -Customer segmentation -Postponement

Quality	-Product and lot-level traceability -Life-cycle tracking of sold products

Many researchers conclude that on the one hand business strategies focusing on cost-leadership need a lean supply chain (Morash 2001; Chen and Paulraj 2004). The lean attribute minimizes the supply chain's inventory, production and transportation costs, which are required by a cost-leadership strategy (Sillanpää & Sillanpää 2014: 95). Both the business strategy and the supply chain strategy strive to minimize costs by economies of scale while manufacturing quality products.

On the other hand, business strategies focusing on differentiation (Morash 2001; Chen and Paulraj 2004), innovation or flexibility, need an agile supply chain process, as the agile attribute adds "high levels of value-added customer service, proactive quality and collaborative communications and interactions with customers" (Sillanpää & Sillanpää 2014: 111). Therefore an agile supply chain also fits well to business strategies following a service or quality approach. Furthermore, agile or responsive supply chains have short lead times that allow reacting flexibly to unpredictable situations.

Figure 9 shows the supply chain strategy framework for lean and agile supply chains. It illustrates that a the situation consisting of a business strategy with a high product volume, a corporate strategy of 'cost leadership' and a predictable demand, requires the supply chain strategy 'efficienciency/ lean'. In contrast, a situation consisting of a business strategy with a low product volume, a corporate strategy approach of 'differentiation' and an unpredictable demand, requires the supply chain strategy 'responsiveness/ agile' (Sillanpää & Sillanpää 2014: 109).

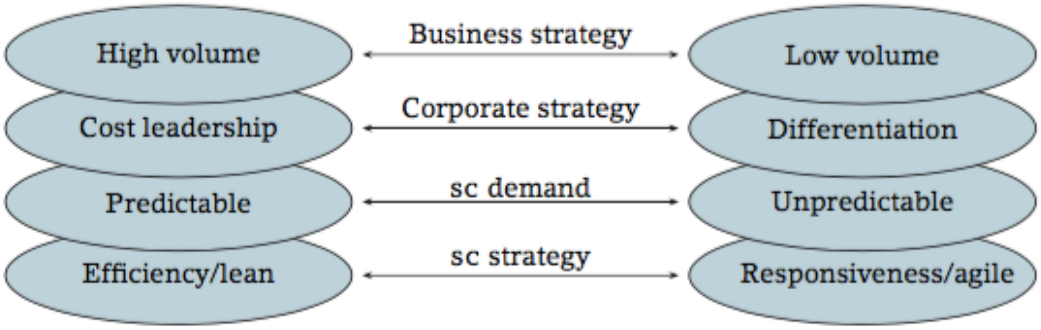

Figure 9: Supply chain strategy framework (Sillanpää & Sillanpää 2014: 108).

The hybrid of lean and agile, the so-called leagile supply chain is a mix of the strategies of cost and responsiveness. According to a company's needs, the suitable aspects of lean or agile SCs can be selected and used in a leagile form. Moreover, Porter (2008) includes the competitive strategy called 'focus' which requires a focus on a particular segment of the product line, geographic market or buyer group to achieve better differentiation and/ or lower costs. Focus can be used with any of the three kinds of SC strategies. These results are summarized in part 4.4. Finally, a company has to clarify five critical configuration components for its supply chain strategy, which are operations strategy, outsourcing strategy, channel strategy, customer service strategy and asset network (Cohen and Roussel 2005). Next, the chapter is summarized in form of a theoretical framework.

4.4 Conclusion: Theoretical framework of the study

Table 6, which is the result of the literature review, serves as the theoretical framework for the thesis. It will be used later to compare the empirical results with. It shows first that business strategies focusing on cost should be best aligned with a lean supply chain strategy. Secondly, companies with a business strategy of innovation, differentiation and/ or flexibility, which are all similar concepts, should best align it with an agile supply chain strategy. Thirdly, companies following a mix of cost and innovation in their business strategies, should best select a leagile SC. Finally, the framework says

that firms with an emphasis on focus in their business strategy can either have a lean, agile or leagile SC while firms emphasizing quality or service in their business strategy, should best have an agile or leagile SC strategy. Lastly, the question remains if Perez 'fast SC' does belong in one category with the 'agile SC' as it is not further discussed in literature.

Table 6: Theoretical alignment of business strategy and supply chain strategy.

Business strategy	**Supply chain strategy**
Cost/ Focus	**Lean**
Innovation/ **Differentiation**/ **Flexibility**/ *Speed?/* Service/ Quality/ Focus	**Agile**
Cost/ Innovation/ Differentiation/ Flexibility/ Service/ Quality/ Focus	**Leagile**
FOR MEDIUM-TO-LARGE-SIZED INTERNATIONALIZED COMPANIES	

5. METHODOLOGY

According to Saunders, Lewis and Thornhill (2009: 3) research methodology refers to the theory of how research should be conducted. In the following paragraphs, research approaches, usage of qualitative data, sampling methods, data collection techniques, semi-structured interviews and the process of data analysis are explained. Furthermore, the main issues of validity and reliability are discussed in order to evaluate the research quality. Finally, the background info for the cases of the empirical part is given.

5.1 Methodological approaches

In the next part, the methodological approaches are explained, starting with the illustration of deductive and inductive approach and followed by the introduction of qualitative and quantitative data usage.

5.1.1 Deductive and inductive research

In scientific research, there are the approaches of deductive and inductive research. They strongly influence how a thesis is structured and conclusions are drawn. Deductive research concerns testing a theory and explaining causal relationships between variables. It often involves hypotheses/ propositions or predictions and empirical testing to confirm or reject the hypotheses. In order to do this, concepts are operationalized to be able to retrieve quantitative data (Saunders et al. 2009: 127). Inductive research is the opposite approach. It has the objective of building a theory after researching data. This data is generalized in order to lead to conclusions, which allows creating a theory. This theory can lead to the explanation of a phenomenon. According to Saunders et al. (2009: 127), the inductive approach helps to understand the meanings that humans attach to events and allows a clearer look on the research context leading to alternative theories after the interpretation of the collected data. The inductive approach is usually intended for the collection of qualitative data and has less need to generalize results (Saunders et al. 2009: 127). Furthermore, a mix of the previous mentioned approaches

exists. This approach, which is called abduction, concerns the development of a theory. Abduction means that researchers make use of existing theories and facts in order to explain the so-called surprise factors (Bryman & Bell 2015: 27).

This research has the goal of a better understanding if and how supply chain strategy and business strategy are aligned. Therefore, this study uses an inductive approach, as its objective is to build a theory for which qualitative data is collected. However, elements of a deductive research are also used as a theoretical framework, which was developed at the beginning and which was then adjusted through the course of the research. Existing literature was used to build this framework. Then the information received from interviews was compared with the theory. This means that the theoretical framework was reviewed in terms of whether it matches the interview results and if it requires adjustments to be made. This process should allow building a comprehensive theory. For this research the framework was designed before the data collection. The reason is that according to Saunders et al. (2009: 490) an inductive approach might be too difficult for an inexperienced researcher because one does not know where to commence the data collection. Thus the advice is that "you will need to analyze the data as you collect them and develop a conceptual framework to guide your subsequent work."

5.1.2 Qualitative and quantitative data

Like Saunders et al. (2009: 484) describe, the qualitative data in this study was collected through the design of a conceptual framework. In general, researchers can work with quantitative and qualitative data. According to Bryman and Bell (2003: 470), qualitative research encompasses all non-numerical data or data that has not been quantified and aims to "capture lived experiences of the social world and the meanings people give these experiences from their own perspective" (Liamputtong, 2010: 11). It is based on meanings that are retrieved from words. Afterwards its collection leads to non-standardized data, which has to be classified into categories. Thus, conceptualization is the approach for analysis. In the analysis process qualitative research underlines interpretation and flexibility. In contrast, quantitative data according to Dey (1993) and Healey and Rawlinson (1994) is based on meanings that are retrieved from numbers.

Subsequently, its collection leads to numerical and standardized data and statistics serve as an approach of analysis.

Researching the topic of aligning the SC strategy with the business strategy can be measured both in a quantitative and a qualitative way. However, it is a challenge to find enough people to gather quantitative data. This is why the qualitative method was selected. Furthermore, discussing issues that involve the topic of business strategy can be quite sensitive, which is why choosing the qualitative method can facilitate the process, as it allows an indirect approach to sensitive issues. In the following part the data collection technique and the sampling are explained.

5.2 Sample and data collection

The sample of the research is limited to German companies as the interviewees are all employees in German companies. This sample's characteristics are selected to have a research focus and to compare this study to other studies that were almost all conducted in Western countries. At the beginning the idea was to focus on the chemical industry due to existing contacts to potential interviewees. However, too many of the additionally contacted chemical companies refused to be interviewed, which would have led to a very small sample size. Thus all middle- to large-sized German companies were considered as the potential pool of interview partners to gather enough data in order to obtain satisfactory results. To add an international aspect to the thesis, besides having an IBS research perspective, all interviewed companies are highly internationalized. Furthermore, a subsidiary of a German company abroad and two foreign subsidiaries in Germany were researched.

5.2.1 Sampling

For this study both purposive/ judgmental sampling and self-selection sampling are used. Purposive/ judgmental sampling means using one's judgment to select interviewees that can best answer research questions and thus best support the goal(s) of

a research. It is often used when only a small amount of samples exists and therefore especially informative cases must be selected. However, cases, which are selected with this method, cannot be generalized (Saunders et al. 2009: 237, 239). The researcher used this kind of sampling to select her contacts. This was done to increase the sample size. The cut-off point with purposive/ judgmental sampling occurred when no new results could be found.

Yet more cases were selected by self-selection sampling. Thus, with the help of the researcher's knowledge about the importance of German firms and with the support of online information, the companies were organized according to their revenue and importance. Afterwards, more than 75 German companies were contacted via email and asked if they would participate in the research. The data was collected from every company that agreed to be interviewed. According to Saunders (2009: 241) the reasons for self-selected cases to participate in a research is because of their opinions or feelings about the researched topic. In this case the sampling went as follows. Usually the public relations departments of big companies were contacted via an invitation email that contained information about the purpose and the reason for the interview and a sample of research questions. Question samples were added in order to encourage employees to participate, as there seem to exist expectations of difficult questions. Some companies asked to receive the whole questionnaire before they agreed to be interviewed, others agreed to be interviewed and then asked for the generated questionnaire for preparation and others participated without knowing the whole semi-structured questionnaire beforehand.

At the end the pool of interviewees of the officially contacted firms turned out to be quite small because lots of the contacted companies refused to participate. Most companies stated that they do not have the capacities as they receive plenty of interview inquiries or generally only support theses that are written by in-house students. Therefore, the cut-off point was chosen when no more interview partners agreed to be interviewed. Furthermore, the interview partners turned out to be a homogenous group as thirteen out of the fourteen interviewees are male, all are German and have similar responsibilities in the company. However, this was to be expected to an extent and

allows an easier comparison of the results. Next, the usage of semi-structured interviews is explained.

5.2.2 Data collection technique

During the research only qualitative data was collected as explained previously to obtain a detailed set of information on supply chain strategies in German companies. Both primary data and secondary data were used. Secondary data was mainly retrieved from the companies' websites. Primary qualitative data was collected through semi-structured interviews. 'Longitudinal' and 'cross-sectional' are characteristics of the time horizon of a study. While a longitudinal study examines a phenomenon over a period of time, a cross-sectional study investigates a phenomenon at a particular time (Saunders et al. 155). This study was conducted as a cross-sectional study due to financial and time constraints. Next, the sampling methods are introduced.

5.3 Semi-structured interviews

Interviews can be standardized, semi-structured or unstructured. Standardized interviews consist of a uniformed structure with carefully planned questions that are presented in the same order and with the same wording. Usually the answers are pre-coded. These types of interviews are usually used to generate quantifiable data. Unstructured interviews and semi-structured interviews are both so-called qualitative interviews. Unstructured interviews are the opposite of standardized ones, consisting of only guiding questions, which allows the conversation to move freely in every direction. They are informal by nature and used to explore deeply an area of interest. The interviewee is encouraged to talk freely about different topics. This kind of interview is also called informant interview as the interview partner guides the direction whereas in a participant/ respondent interview, the interviewer leads the interview in certain directions (Saunders et al. 2009: 320 – 321).

For this research, the primary data sources are semi-structured interviews. For this kind

of interview, the researcher has a list of topics to talk about but the specific questions and the order of the questions vary between the interviewees while additional questions might occur (Saunders et al. 2009: 320). This method allows the researcher to have a general outline of topics while it also provides the opportunity of asking additional in-depth questions. This again allows enough freedom to retrieve material about issues that might not have been considered by the interviewer beforehand. In general this method is best described by qualitative interviewing, which is "an interview, whose purpose is to gather descriptions of the life-world of the interviewee with respect to interpretation of the meaning of the described phenomena" (Kvale, 1983).

According to Sekaran (2003), the advantages of doing a personal interview are the chance for the interviewer to build rapport with the interview partner, the possibility to clarify questions and the opportunity to observe nonverbal behavior. However, the disadvantages of face-to-face interviews are that they are costly, require a location and the interviewer's bias might influence the interviewee's responses. In contrast to that, telephone interviews are less costly, don't require a location, allow reaching out to a wide geographic area and provide higher anonymity (Sekran 2003). Anonymity seems to be an issue in medium-to-large-sized companies as most interview partners requested to be cited as 'anonymous'. Due to these reasons the interviews were conducted via phone/ Skype. Furthermore, they were on a one-to-one basis as Sekran (2003) suggests that an in-depth analysis is best performed in one-to-one interviews.

A preliminary pilot test was executed before the final interviews to test and adjust the questions. It helped to integrate more open-ended questions and to reformulate a lot of questions and in turn increased the reliability and validity of the content. Afterwards, there were 14 interviews conducted with people working in supply chain or business management, which allows them to have sufficient knowledge of the company's SC and business strategy. Furthermore, the interviewees are mainly from the B2B field. This number of 14 interviews is not meant to lead to generalization, but will give an idea about the existence of an alignment between the strategies.

Business strategy is a sensitive topic for companies. Thus one cannot ask directly for the business strategy of a company. That is why the invitation email had the purpose to inquire if a company is willing to give an interview about supply chain management and strategies. Furthermore, the questionnaire was designed in a way to ask indirectly for the alignment of SC with the business strategy by questioning categories like the operational structure, demand, customer requirements, product specifications, strategies for a company's suppliers and asset network. These categories should allow conclusions about the SC strategies.

In order to encourage the interviewees to share as much information as possible, most of the interview questions were open-ended. The more interviews were conducted, the more questions and new topics came up in the interviews like the meaning of computerized systems for the SC in industry 4.0 or the SC changes over the years. As the SC is quite a broad subject with the five functions of planning, sourcing, making, delivering and returning, and due to the nature of semi-structured interviews, a lot of content could be acquired. To find a comparable structure for the interviews, the questions were arranged around certain main topics. These main topics and their reference to the literature can be found in the following table (table 7).

Table 7: Main topics of the semi-structured interviews.

Topic	Information obtained	Theoretical reference
Introduction	-Financial range -Function of interviewee in company -Activities in the market (5 forces) -Industry field	
Operational structure	-Criteria of production planning -Production strategy	Cohen and Roussel 2005; Sehgal 2009; Gupta et al. 2009; Lee 2002; Lee 2009;

		Qi et al. 2009; Roh, Hong and Park 2008; Sillanpää and Sillanpää 2014; Morash 2001; Chen and Paulraj 2004; Chopra and Meindl 2007; Gupta et al. 2009; Balasescu and Balasescu 2014; Rose 2012; Sehgal 2009
Demand, customer requirements	-Demand curve -Customer segmentation -Service levels	Cohen and Roussel 2005; Sillanpää and Sillanpää 2014; Mason-Jones et al. 2000b; Lee 2009; Gupta et al. 2009; Hilletofth 2009; Goldsby et al., 2006
Product	-USP -Specialized product	Balasescu and Balasescu 2014; Mason-Jones et al. 2000; Christopher et al. 2006; Fisher 1997
Own suppliers	-Sourcing strategies	Lee 2002
Focus	-Focus on particular segment of the product line, geographic market or buyer group	Porter 1980
Asset network	-Global/ regional/ country model	Cohen and Roussel 2005
Changes	-Changes over the years -Decisions about SC	
Future	-Industry 4.0	Cohen and Roussel 2005
Summary and additional comments	-Key criteria and challenges for the SC -Application of the three	

	archetypes (lean / agile / leagile)	

The interviews were organized in Germany from October to December 2016. This kind of approach was selected due to cost restrictions and the short time frames that the interviewees could offer. The interviews were conducted in the mother tongue of the interview partners, which is German. They lasted each between 20 minutes to over one hour with an average length of around 40 minutes. All interviews were audio-recorded and notes were taken during the interviews. Naturally, the consent of the interviewee was acquired prior to the recording. Each interview and the respective notes were saved in an anonymized file called “Company A”, “Company B” etc.

The transcribed data was sent to the interviewees for confirmation and possible changes as it was agreed with each of them during the interview. Depending on the preference of the interview partner, the respective company was anonymized. During this correction process a lot of interviewees requested changes, mostly concerning their quotes. Thus, e.g. company D stated that it does not wish to be cited at all. Therefore, no direct quotations were included in the final analysis of that company. Moreover, company K (concerning the order of the letters, ‘I’ was skipped because company ‘I’ could lead to confusions with the pronoun) chose to be anonymized. In the following part the data analysis process is explained.

5.4 Data analysis

The collected material of a qualitative study is naturally unstructured. Furthermore, qualitative data has consequences for the analysis due to its complex nature and non-standardization. Miles and Huberman (1984) suggest that the obtained data, which is all based on text in forms of transcriptions, notes and written documents, requires structure. However, at the same time the original data has to be kept. To follow this advice, after a maximum of two days after conducting an interview, it was transcribed and analyzed to

record the information as accurately as possible. This short time frame was selected due to Saunders (2009: 490) advice for inexperienced researchers to analyze the data as they collect it. The interview with company A was not transcribed, as the interviewee did not allow a recording. Therefore, the analysis consists only of notes for company A.

For the transcription process the following information is important according to Saunders (2009). The interviewer is not only interested in the content of what the participant says, but also in the meaning, tone and non-verbal communication. In this study these aspects were included in the transcription by using the respective expressions. Next, the challenge of qualitative data is that words can carry multiple meanings; they are ambiguous, not objective. This is why the data has to be analyzed. A content analysis helps to extract information from the gathered data. To conduct a content analysis, the qualitative analysis process by Saunders (2009) was used. In this approach, the meanings are summarized or condensed. Furthermore, the categorization or the grouping of meanings is conducted. Moreover, the structuring of the meanings is done using narrative. According to Saunders, these processes can be used on their own or in combination. Additionally, the IBS perspective influences the analysis process. Next follows a figure (figure 10) that visualizes how theses processes were used in the data analysis for this particular research.

Thus, after reading the transcriptions and the notes of each interview to get familiar with the content, the most relevant parts of the transcribed material were highlighted. Then the content of these parts was summarized and categorized under the main topics of the questionnaire. These topics were selected according to the objectives of the thesis and in comparison with the theoretical framework. Next, the relevant quotes supporting the claims of the interviewees were selected and then translated from German into English. These quotes represent the most important information that was obtained during the interviews. Quotes allow clarifying and illustrating the narrative of the final result analysis (Saunders 2009). Naturally, the agreement of quoting an interview partner was obtained. Next, all this information was transferred into a new document in order to structure it in form of a narrative. These results are presented in the next chapter.

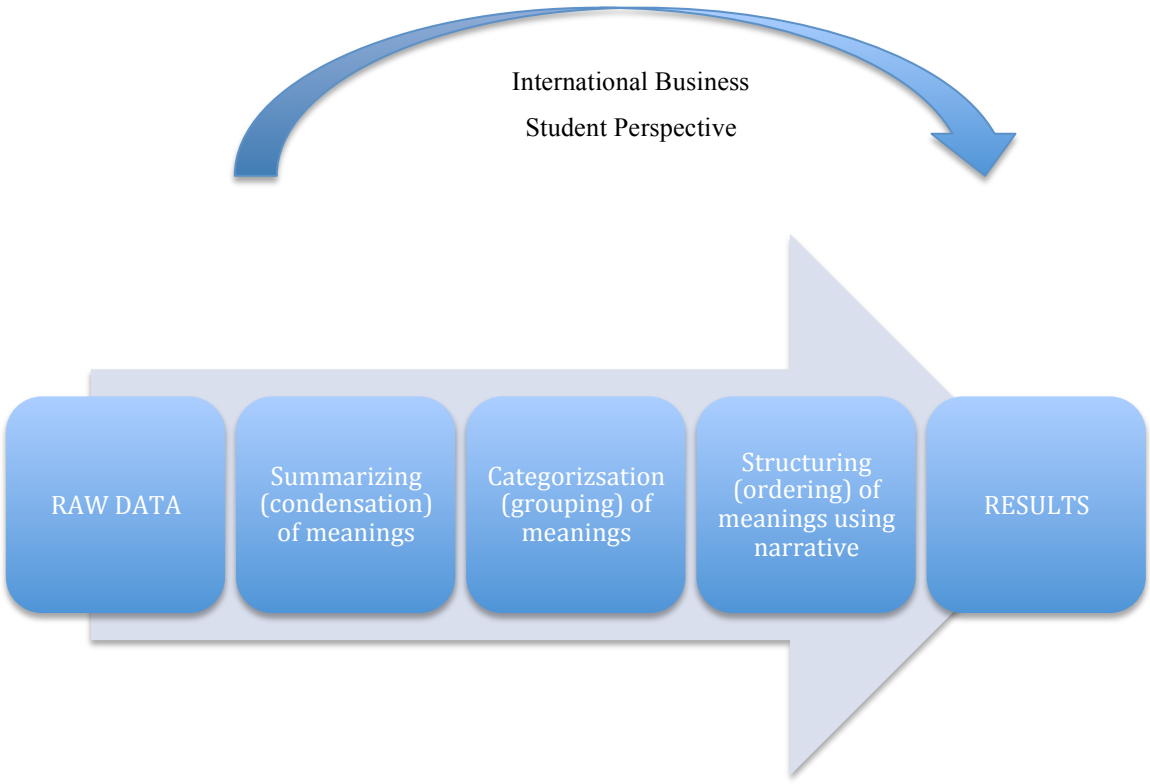

Figure 10: Qualitative data analysis process according to Saunders (Based on Saunders 2009).

Additionally, significant data that can be compared between all the interviews was transferred into an Excel sheet. The tables at the end of chapter 5.6 and 6.6 provide a short overview of each company and a quick comparison of the main information. Next, the reliability and validity concerning this study are evaluated.

5.5 Reliability and validity of the study

The quality of a research is best measured with the concepts of validity and reliability. Usually these terms are associated with quantitative research, but can indeed be used with both quantitative and qualitative research. The quality of this study was enhanced

through the usage of both primary and secondary data. This allowed integrating two kinds of sources and consequently is an enhancing feature.

Validity means if the findings really show what someone intends to measure. It allows finding a casual relationship between variables. To achieve validity, the questionnaire was tested before it was used in the actual research. Furthermore, it was originally developed in German and therefore carefully worded in the mother tongue of the interviewees. Information from existing studies was used to create categories and to formulate questions.

According to Saunders et al. (2009: 156) reliability is "the extent to which data collection techniques or analysis procedures will yield consistent findings." This means that the results of a certain study should be the same at different points of time and/ or with different researchers. According to Robson (2002) there are four threats to reliability: participant error, participant bias, observer error and observer bias. This research intends to decrease participant error by choosing a majority of the sample based on self-selection. Consequently, only participants that were motivated to share their experience were part of the study. To avoid participant bias, the interviewees could choose to conduct the interview in an anonymous way, which allowed them to build trust to the interviewer. In order to reduce observer error, semi-structured interviews were selected to be the research method with a planned structure of the questions in order to guide the interviewer. Choosing to conduct the interviews via phone/ Skype lowered observer bias.

A final issue is the external validity or generalizability. The sample used in this study is very small and therefore it is hard to generalize results. However, some results go along with results from existing studies and thus allow comparisons. Yet this study is exploratory by nature in order to contribute to existing research. Its intention is to encourage further research of bigger sample sizes that again allow generalizations. Furthermore, Saunders et al. (2009: 127) claim that the inductive approach, which is used to gather qualitative data, has less need to generalize results, which is applicable in this case. Next, the background info for the cases is given.

5.6 Background info for the cases

This research comprises of 14 cases from 13 different companies, as one company is the American subsidiary of one of the German companies. The main categories that are examined in each company can be found in table 7. Next follows a short overview of the results referring to these main categories to provide background information.

The industries of the interviewed companies encompass agriculture, chemistry, construction/ engineering, electronic/ mobility, food production, pharmacy/ health care, protective coatings (paint), salt and potash, and sterilization. The companies generate nine million as the lowest to several billions euros as the highest revenue. All companies are highly internationalized. Furthermore, one German subsidiary is in the USA, one subsidiary of an American company is in Germany and one subunit that used to be a German firm, but is now a subsidiary of foreign headquarters in Germany, were interviewed. This choice of companies contributes to the international background of the study. The responsibility of the interview partners was mainly directly in the SC/ logistics or business management. However, one interviewee from Hochtief also works in the communications department. Therefore, the given information might not be as deep as a supply chain manager could have provided. The other interview partners who were not directly from the logistics department, are one chief executive officer (CEO) who offered the broadest view over his whole industry, one plant manager, one business line manager, one maintenance manager and one employee from the international business department, who are all informed about their company's SCM and business strategy. The majority of the companies that was generally open for interviews are mainly in the B2B field and thus are barely known to the common consumer. Consequently, almost none of the companies or brands that are popular among German consumers was interviewed except Bayer. The following tables summarize the results. In the next chapter follow the empirical findings and their discussion.

Table 8: Background info for the cases.

Company	**Company A**	**Company A - Subunit**
Date of interview & Interviewee	18.10.2016, Anonymous	25.10.2016, Anonymous
Industry sector	chemistry, specialty chemicals	chemistry
Products/ Service	chemical	chemical
Revenue (in €)	13.5 billion	500 million
Internationalization	high	subunit in USA
Interviewee's function	Plant manager	SC manager
B2B or B2C	B2B	B2B

Company	Company B	Company C
Date of interview & Interviewee	21.10.2016, Anonymous	27.10.2016, Anonymous
Industry sector	chemistry	pharmacy, health care
Products/ Service	pharmaceutical	drugs, medical products and service, medical machines (capital goods)
Revenue (in €)	> 100 million < 500 million	15 billion
Internationalization	high	high
Interviewee's function	SC manager	Director of supply chain for finished goods in the region EMEA (Europe, Middle East & Africa)
B2B or B2C	B2B	B2B and B2C

Company	Company D	Company E
Date of interview & Interviewee	04.11.2016, Anonymous	04.11.2016, Anonymous
Industry sector	electronic, mobility	wholesaler in agriculture, delivery to own shops
Products/ Service	mobility, services	products for 6 different markets
Revenue (in €)	8 billion	40 million
Internationalization	high (around 35 countries worldwide)	purchase international, sales focused on Germany (only one area, also international trade)
Interviewee's function	Director of the sales division mobility	Director of logistics
B2B or B2C	B2B	B2B

Company	Company F	Company G
Date of interview & Interviewee	06.11.2016, Anonymous	12.11.2016, Anonymous
Industry sector	food producer	construction
Products/ Service	pastries	building material and building chemistry
Revenue (in €)	some millions	100-120 million
Internationalization	high	German subunit of European company, 5 subunits in Europe
Interviewee's function	Regional sales manager	Department international business
B2B or B2C	B2C	B2B

Company	Company H	Company J
Date of interview & Interviewee	10.11.2016, Anonymous	15.11.2016, Anonymous
Industry sector	paint	chemistry
Products/ Service	protective coatings, anticorrosive coating	functional silanes and chlorosilanes
Revenue (in €)	11 million	200 million
Internationalization	60% national, 30% European, 10% worldwide of sales	high, global customers
Interviewee's function	Owner, CEO	Business line manager
B2B or B2C	B2B	B2B

Company	**Company K**	**Bayer**
Date of interview & Interviewee	08.11.2016, Anonymous	28.11.2016, John Koelnik
Industry sector	sterilization service	pharmacy, health care
Products/ Service	sterilization of medical material	drugs, medical products and service: crop science und consumer health und animal health
Revenue (in €)	9 million, 40% increase currently	20 billion
Internationalization	German subunit of American company	high
Interviewee's function	Maintenance manager	Head of Corporate SC
B2B or B2C	B2B	B2B and B2C

Company	**K+S**	**K+S**
Date of interview & Interviewee	26.10.2016, Thorsten Wendt	26.10.2016, Thorsten Wendt
Industry sector	raw materials	raw materials
Products/ Service	potash	salt
Revenue (in €)	ca. 3 billion	ca. 3 billion
Internationalization	high (Europe, South America and Asia, soon North America)	high (Europe and North America)
Interviewee's function	Vice President SC management of potash division	Vice President SC management of potash division
B2B or B2C	B2B and B2C	mostly B2B

Company	**Hochtief**
Date of interview & Interviewee	21.10.2016, Dr. Bernd Pütter
Industry sector	construction, engineering
Products/ Service	construction projects
Revenue (in €)	24 billion
Internationalization	high, 95% of business abroad
Interviewee's function	Director company communication
B2B or B2C	B2B, B2C

6. EMPIRICAL FINDINGS AND DISCUSSION

In this chapter the research question is discussed as the empirical findings of this study are presented, analyzed and discussed from an IBS perspective. Thus, information about SC management and its alignment with the business strategy in German companies is presented and examined. Simultaneously, the findings will be compared to the developed framework of chapter four. In order to answer the research question and to reach the goals of the thesis, the previously presented research methods are used. A tabular overview of the companies and main findings can be found at the end of chapter 6.6. The empirical part presents the research results of the lean, agile, project, leagile, capable and risk-hedging SC strategy. Finally it concludes with the alignment and effectiveness of the strategies. Note that some of the companies have several SCs or follow several SC strategies simultaneously. Thus, the results are often intertwined and this is why for each company one strategy is prioritized in the presentation in order to be able to categorize it under one SC strategy. A comprehensive overview over all the companies and their discussed SC is given in chapter 6.7.

6.1 Lean supply chains

The lean SC was found especially in companies producing commodities. As the literature suggests, lean SCs are about eliminating waste and reducing costs in forecast-driven operations with predictable demand. Company A has a lean SC for chemical products that are ordered regularly in a ‘make to stock’ manner. The company’s products are demanded seasonally e.g. used for construction work or as ingredients for sun protection products but are demanded every year again, which means that stock must be created to fulfill demand when it occurs.

Another example for a lean SC is the chemical subunit of company A, which competes through having the lowest price of its chemical in the region. The reason for this low price is to prevent potential competitors from starting to produce the chemical and

especially the chemical's derivatives as the main revenue is generated through the derivatives. This production is somewhat managed in an agile manner as it is decreased when demand declines due to the fact that the chemical cannot be stored long-term in rail tankers, which are also used to transport it. However, in general the demand is quite stable which is why the company thinks about increasing production. Another factor that influences the potential production increase is that the plant requires disconnection from time to time to change catalysts etc. This is why in these situations the chemical must be delivered to other global production plants to fulfill demand there.

> *"When there is no demand, the production is lowered, but we are thinking about using maximum utilization." (Subunit of company A).*

The company implemented a customer segmentation according to sales volume. Service levels involve transportation when a customer orders the derivatives, which are toxic and therefore require special transportation. The USP of the products is clearly their technological advancement. Furthermore, the company does not need to compete with local rivals and therefore has a location advantage.

A further typical lean SC is found with company F, which is a pastry producer with a focus strategy of a target group of young people between 10 to 35 years. The firm's product line consists of certain standardized products. Its production is planned according to forecasted demand, available shelf space and product placement in a 'make to stock' manner. Although the demand varies over the year e.g. decreases during festivities and school holidays, this cycle repeats annually and consequently is predictable. If the products were not available, customers would buy elsewhere, which shows that this commodity product is replaceable. After all the interviewee admitted that the key criteria is to *"have a profit margin as high as possible as bills must be paid (Company F)"*.

Another lean SC is found in the company K+S. This firm mines the raw materials salt and potash. It has three fields of work, which are the sectors thawing salt, potash fertilizer for agriculture and industry, and salt products for health care and nutrition. The majority of the products are commodities, which differ only through the price from the competition. Salt and potash are typical mining products, which require high capital

investment and high rates of labor force and are strongly oriented towards quantities. These days the company has to adjust its production more towards market demand along with a maximum possible utilization. Yet K+S deals with very seasonal demand both for potash and salt as the former is mostly used during spring as fertilizer and the latter as it is mostly used during frosty winter times. However, to fulfill this seasonal demand, the production should run with a high utilization for the rest of the year. This leads to the special issue in the delivery part of the SC regarding storage space issues, which is explained in the following sections.

The first discussed SC of K+S concerns the potash fertilizer sector. For potash, customers are classified as wholesalers and retailers and customer segmentation is based on the purchased amounts. The wholesalers, which are the most important customers, have a payment function for K+S and a financing function for end customers, who are farmers. The issue is that the wholesalers try to conduct purchases as late as possible close to the next spring season unless they get an incentive earlier by low prices. Yet K+S does not have the storage space to stock the products until they are demanded in the season due to high capital costs of storage units.

> *"Here we can store for two months in one or another plant, (...) but then we have to get rid of the goods, (...) it is a tight cooperation between sales and production." (K+S)*

The only differentiating feature of this commodity is the price.

> *"Here in the company around half of the products we sell are commodities and commodities by definition do not differ from the competition." (K+S)*

Yet the prices in the fertilizer markets are highly volatile. Customers try to buy products just-in-time in the spring season and they try to avoid long-term commitments. Therefore contracts are difficult to agree on with wholesalers in the preceding summer. Instead only target agreements exist. Therefore the challenge of this SC deals especially with managing the products produced between July and February in order to be able to produce at full capacity, avoid downtimes and have the incoming payments from the wholesalers. A further challenge lies in the transportation, which creates a challenging

situation in the delivery part of the SC. The interviewee expressed the challenge in the following statements:

> *"To transport goods from the production to the farmer is constantly a challenge for us. (...) The challenge for the SC is the alignment with the seasonality. Therefore we have to create possibilities. You must imagine that the production runs at 100% each month while the products are only needed during three to four months in Europe." (K+S).*

Concerning the transport the interviewee said:

> *"We are one of the biggest train customers in Germany (...) in Europe we use the inland waterway transport (...) and trucks (...) and to coordinate this with each other, this is the permanent challenge. The products are shipped in bulk and you cannot store it outside somewhere (...) we have to have the appropriate equipment for transshipment." (K+S).*

Furthermore, K+S claims on its website: "Efficiency, reliability and flexibility are the core characteristics of our delivery service. The key to our successful supply approach is the coordination of rail, inland water barges, seagoing vessels, container and truck deliveries. We set great value on stable and long-term cooperation with our logistics service providers. This is why we select our partners with more than just financial aspects in mind; ecological and social responsibilities are increasingly more important." (K+S 2015a). This shows that even in the commodity sector, quality of logistics in the delivery part is a differentiating service factor for this company.

The second discussed SC concerns the salt sector. This field of work is a bit differently structured, as customers are mostly municipalities for thawing salt, which is why the sector deals mostly with public calls for bids. This means that the value of the product is even lower. Here, another challenge lies in the weather conditions. When stocks of thawing salt still exist due to a preceding mild winter, the demand for the product is lower.

The other fields of activities concern industry and pharmaceutical products, the so-called healthcare and nutrition sector in which the demand is stable and margins are higher. Yet the total demand for these products is also lower. Furthermore, K+S has to

deal with a lot of certifications in the pharmaceutical industry, which requires a capable SC (see chapter 6.5 Capable SC). Due to these preceding reasons the commodity production is prioritized both by the company and here in the analysis.

Furthermore, the lean SC of the sterilization company K, which is a company providing sterilization service, is discussed. Currently the company provides sterilization services only for medical products, but plans to expand this service also to pharmaceutical products. This service is conducted in the following manner.

> *"Company K manages the customer's goods, but they stay property of the customer. We undertake a processing, an enhancement in value, (...) but then we return the goods." (Company K).*

Company K has a lean SC, which is strongly focused on the monetary aspect. A financial investor owns the company and therefore puts a lot of price pressure on it, which leads for example to the consequence that high price increases for the service were implemented. Furthermore, the firm has a policy of limited storage space. This means that it avoids to stock goods due to the reason that medical products require certain kinds of storing conditions because they *"cannot be stored under standard conditions (Company K)"*. The company does not own the appropriate facilities as its process *"does not earn money with storing (Company K)"*. A further characteristic of the provided service is the strict punctuality in the order fulfillment that the company strives for in order to maximize its revenue. Company K's lean SC strategy results from the fact that the process steps of sterilization are standardized. Thus the firm became aware that certain steps in the validated process have to be followed and decided to clock its incoming orders to maximize its utilization and consequently to achieve as much revenue as possible. Furthermore, the service is scheduled according to customers' inquiries. The customers receive a time frame during which they have to deliver the goods in order to sterilize them. These orders are theoretically equally distributed over the year, while in reality demand shows a decrease during holidays. Delivery reliability is not only important for the customer, but also for the company because conducting the different process steps on time is important to fulfill all incoming orders and to approve the execution of a process as successful.

> *"This process of sterilization is time-sensitive. For us time is important to complete the process successfully or to assess it as successful. (...) If the whole process is unsuccessful because we did not comply with the time frame, it is very critical for us." (Company K).*

Next, agile supply chains are discussed.

6.2 Agile supply chains

According to existing literature, agile or responsive supply chains have short lead times that exist in order to react flexibly to unpredictable situations. The main objective of the agile SC is to provide superior customer service. Company B, which is a chemical company, has an agile SC for pharmaceutical products that are developed in projects. These projects are short-term and solely according to customers' needs and thus they must be agile.

> *"The pharmaceutical business is not that short-term oriented. Yet the project business is very short-term of course, there you have a customer inquiry, which you have to answer until a certain point of time in order to make an offer to the customer. If the client orders, he usually wants to receive the product relatively fast. Then you have to put a certain amount of effort into the development of the project and then he receives it with several weeks of lead time." (Company B).*

The projects are selected according to fit-to-technology.

> *"First of all it must fit to our technology. We cannot do everything. We have certain technical capabilities to which the customer's orders must fit." (Company B).*

Furthermore, the company hopes to receive permanent business from these projects.

> *"The customer must be interesting for us and the project must have future potential to invest effort into it." (Company B).*

However, the success rate of these projects is low and consequently also the chance to win long-term contracts is low.

> *"The success rate of these projects is less than 5% because they go through a lot of clinical phases and this can take up to 10 years." (Company B).*

> *"The possibility is high that it* (the project) *does not succeed in the first attempt." (Company B).*

> *"It is a kind of a lottery with the goal to establish a close customer relationship (...) this is why you have to know if it* (the project) *fits to us and our technology, if it is not too costly and if we see potential in the customer (...) and if we see potential in the customer in terms of strategic interests." (Company B).*

Next, the project SC and its distinguishing characteristics in comparison to the agile SC are discussed.

6.3 Project supply chains

Project SCs are, as the title indicates, SCs specifically for projects with no existing supply chain or facilities. This characteristic differentiates it e.g. from company's B agile SC as there the company can make use of pre-existing facilities. A project SC must first be developed. Another distinguishing feature is that demand is not as unpredictable as it is for the agile SC because for example conditions are contractually agreed with the customer before a project starts. Furthermore, projects are defined by their nature to take place over a fixed period of time. The same goes for the SC in this case, which is temporarily fixed. This last characteristic is also different from the agile SC, as there exists no pre-defined time frame. The characteristics that both project SCs and agile SCs have in common is their agility, flexibility, customer closeness and customization, as projects are custom-made 'products' according to the customers' demands and wishes.

One industry branch that works with project SCs is the construction industry in which the company Hochtief operates. Each one of Hochtief's projects is unique.

> *"We do not produce products, we produce projects and every project is different and so we have a unique production and the procurement processes are dedicated to this unique production." (Hochtief).*

Hochtief deals with a stable demand, while the execution of the construction projects is seasonal with a decline during winter. The customers are both from the public and private sector. While a central procurement department orders some materials, most of them are ordered regionally depending on the project's location. The majority of the required products depends on the project. Therefore, long-term contracts and lean

management are often not applicable. On the project level the subcontractors usually purchase the materials they need.

> *"The procurement of certain things is coordinated centrally – company car, IT and such topics. Otherwise the procurement process is usually on the project level because you purchase the products for each specific project." (Hochtief).*

Procurement or sourcing is one of the most important functions of the SC as the company "spends more than 60% of its entire business volume on procuring products and services. In 2014, this amounted to a total of 15.8 billion euros" (Hochtief 2016). This shows the high procurement costs that are involved in establishing a functioning project SC.

The electronic corporation company D has another project SC, which is dealing with mobility solutions. Its customers are few privately operating companies and mainly companies from the public sector offering mobility solutions, which often have ties to the federal government or city authorities. When dealing with such customers worldwide, company D always has to abide with each country's specific regulations. The company offers so-called "turn key projects", which are holistic mobility solutions consisting of different services and products, all from one company depending on the regions' needs. This type of SC is completely customer-focused. When a solution is demanded, the company develops and delivers a customer-specific project just for this particular client. The demand is affected by overall economic cycles and it is higher in countries where mobility solutions are not yet that available as they are in Europe. Thus, the Middle East, South America and Asia are upcoming target markets due to cities' high demand for mobility solutions. Yet, the decisive factor is the financial stability of the client because of the high costs of these projects. The company has a peculiarity in the making function of the supply chain with its suppliers, as there is a limited number of suppliers in the market (see chapter 6.6 Risk-hedging SC). In summary both kinds of the discussed project SC are SCs for high-priced projects that require a creation from scratch and high agility, making each of them unique. Next, leagile supply chains are discussed.

6.4 Leagile supply chains

Company E's SC for wholesale follows a leagile SC strategy as on the one hand there is an emphasis on quality management and optimizing costs in the delivery part while on the other hand delivery reliability and flexibility are emphasized. The SC, that was discussed, concerns getting the goods from global producers into company E's stock and then transporting them from there to the company's shops in Germany. The goods are ordered from the producers and depending on the location, the delivery time can vary between one week and six months. Furthermore, the order of products for sales campaigns can be planned up to half a year ahead. The demand for some products is stable while for others it is more seasonal while a third category are the promotional goods. Promotional goods or campaigns are seen as surplus demand, which according to literature can be managed in an agile manner with an overall leagile SC strategy (Goldsby et al., 2006).

Challenges for company E's SC encompass to not having too many products stocked, but sufficient products available to be able to serve the customers. Furthermore, the turnover rate of these goods should be high, the goods should be delivered to the shops on time, in the right quality and quantity and the transportation costs should be optimized. Here, similar to K+S, the delivery part of the SC has an important role as the company focuses on so-called *"milkruns"* in contrast to general cargo haulers. 'Milkrun' means that when loading one of the companies' trucks, goods from different areas of the company's business are pooled together and are delivered to several big markets in one region. The advantages of this method are that costs can be kept low while the quality can be kept high because the goods are only few times reloaded. Furthermore, the truck drivers are often familiar with the customers and their needs, which results in a high service level. This approach, which is focusing on cost-efficiency, is the lean part of the SC.

The other type of transportation involves general cargo haulers who handle the goods several times and therefore the damage rate is higher and the arrival quota is only between 90 – 96% in contrast to close to a 100% of the milkruns. Thus, the usage of haulers is kept as low as possible. However, the usage of cargo haulers seems necessary

to increase the SC's agility and thus makes the company's SC a leagile one. In the SC of sourcing, the company also emphasizes delivery reliability and quality**.** The firm prioritizes delivery reliability due to the reason that the customers, who are in this case the shops, hire temporary staff for stowing the goods. Consequently, the shops expect a punctual delivery. Furthermore, the high quality of the products with the company's brand on them is important to make a contrast to other branded products.

Besides the company's own products, it also sells commodities. The interviewee's statement *"it is hard to define a USP for our commodities (Company E)"* leads to the conclusion that it is even more important for the firm to distinguish from the competition in this field regarding the price, which can be lowered e.g. through milkruns. It general it can be assumed that there is no specialized competition on quality as a high quality of the products is usually taken for granted. In conclusion this strategy requires lean features for the price, but also agile features to achieve delivery reliability, thus a leagile SC.

A further kind of leagile SC is found with company H, a company that produces paint products. Especially the agile SC for protective coatings was discussed. The company's production is conducted half in a 'make to stock' manner and half in a 'make to order' manner, which is a typical characteristic of a leagile SC. The demand for the coatings is seasonal with peaks in spring from February to April and in autumn from September till October. The reason for the peaks is that part of the products goes into construction work outside.

Company H's customers are segmented into markets like steel, bridges and facilities. Generally, it mostly deals with firms from the private sector. In the public sector it only trades with intermediaries. One of the company's services involves the creation of control areas to check the quality of the product as a one company delivers the paint and another one actually paints the objects. This control supports the determination of errors for possible clarifications. This is a part of the planning function of the SC as it concerns the creation of explicit accountabilities as defined in chapter 3.2. Furthermore, another service concerns the introduction of products to customers if they have not

worked with a specific product or a certain technique yet. To offer these services, a constant balance between service and costs has to be found. The product protective coating is a commodity, which does not have a USP compared to substitutes, as there are standards that must be complied with. Commodities are usually managed in a lean SC. The distinguishing factors of service and delivery speed are implemented in this case by using an agile SC in order to create a USP and additional value for the customer.

> *"The recipe is predefined. Thus, you can only differentiate few things about the product. You have to differentiate yourself through service, e.g. speed of delivery (...). This means that the SC is the distinguishing factor directly supporting the business strategy." (Company H).*

In general the company offers a regular lean delivery of other paint products, but also an agile SC for projects that require protective coatings, which is defined by the owner of company H as follows.

> *"The company as it is has to do the management of the projects. This means that I have to manage my project and the usual operations together. Let's take an example. Let's say I win a bridge project. There is a limited amount of protective coating. Then for this project the warehouse logistics and production sequences will be planned separately* (from the rest of the company's operations)*." (Company H).*
>
> *"If we win a project* (additional to the usual stock management)*, then the sales department manages it additionally. This means that we have to increase stocks." (Company H).*

For increased flexibility the company "*has half finished products (...) so you just have to add the pigment or coloring (Company H)"*. The interviewee describes a further challenge of managing production as follows.

> *"The objective is to align production capacities and stock capacities. This is the distinguishing factor so that stocks are not too high and the delivery reliability is secured. This again means that the production must be very flexible." (Company H).*

Thus, company H combines a mix of lean and flexible SCs with different products on the same plant following standardized manufacturing steps. For the protective coatings

only the mixtures are customized. No rebuild of facilities is necessary. By having a lean SC for other products in order to utilize its capacities and an agile SC for the protective coatings, company H created a USP in its business strategy. With the agile SC for the protective coatings, company H is able to have its products available when needed within 24 hours nationwide in Germany. Big competitors rarely achieve this goal. This is why company H can win over orders from its competition and is able to supply projects better. Delivery reliability is important for the company, as it is the distinguishing factor from the competition. Furthermore, in the paint business the delivery on time in full is extremely important.

The interviewee worked in two companies, which manufacture paint products. He said that his medium-sized company with a revenue of 11 million euros has the advantage to react much more flexibly than its competitor with a revenue of 1.3 – 1.5 billion euros. The big competitor uses stocks to react flexibly to fulfill demand instead of planning ahead. The interviewee describes this in the following way.

> *"There exist oversized stocks, which is criticized by the SC management. Then it is corrected. This results in an ongoing internal power struggle between sales and SC." (Company H).*

According to the interviewee's experience the interface between the sales department and the SC is not managed properly here. The SC management has usually primary responsibility. He proposes that there should be more coordination between the departments. Here, the lacking alignment of the strategies is an issue, which is further discussed in chapter 6.7. Next follows the introduction of the 'capable' SC.

6.5 Capable supply chains

A different type of SC, the capable SC, is not mentioned in the literature. Generally it has attributes of both lean and agile SC strategies. The agile aspect is the customer closeness while the lean characteristic is the predictable demand. Generally, it is always important to keep costs at a reasonable level. The difference to a leagile strategy is that there does not exist an application of the Pareto rule, a base demand or an order

penetration point. Instead the whole supply chain and range of products is oriented towards delivery reliability and speed.

As an example to explain this kind of SC, serves company B, which is a chemical company producing pharmaceutical products. Previously, the company's agile SC for its pharmaceutical projects was discussed. The following SC results from these preceding joint pharmaceutical projects, that were given to the company in a small scale and are afterwards regularly demanded by the customer.

> *"It is an established product which once started at a small scale and then successfully developed over the time. It is already optimized in the production. The customer agreed e.g. on a five-year contract with defined volumes. It is well predictable and recurring." (Company B).*

For the case that is examined here, a lean, cost-efficient SC is only possible to a small extent due to the industry, which is strictly regulated and requires complying with GMPs (good manufacturing practices).

> *"GMPs are a special characteristic. Complying with GMPs is especially important with pharmaceutical products (...) It is exactly determined how one has to manufacture it* (the product*), in which steps and interim steps, how everything is handled, the specifications of the raw materials (...). I cannot take the raw material from another supplier because it is cheaper (...) If I want to do this the whole process must be revalidated." (Company B).*

> *"The whole process is inflexible with GMP. Yet this is also the entry barrier for the competitors." (Company B).*

Typically a lean SC is characterized by regulations and standardization. Moreover, the customer demand for company B's products is relatively stable due to contracted volumes, which is usually a characteristic of a lean SC. However, the firm's SC is characterized by customer closeness, which would lead to the assumption of an agile SC strategy. A key KPI of the capable SC is delivery reliability. In this case it is even more emphasized due to the pharmaceutical industry for which high reliability is requested.

> *"You must fulfill what you agreed with the customer by contract. Thus you must exactly deliver to the customer this product, of this quality, at this time, etc. exactly like he planned you to do, like he wants you to do." (Company B).*

This mix of delivery reliability, predictable demand, customer closeness, but lower cost-efficiency is called capable SC.

Furthermore, company B's own products for its own market, the so-called over-the-counter products, which are made in a 'make to stock' manner, can be seen as part of this category. The company uses a mix of lean and capable SC, but with a stronger focus on capable. The capable feature with an emphasis on delivery reliability is due to operating in the pharmaceutical industry. For its own markets, company B also strives to be lean, meaning cost-efficient. However, here again must be emphasized that costs are always important, but not prioritized in this case. Instead the company focuses on *"availability, reliability and certification. Costs are always important and to be minimized, but not at the expense of availability and quality (Company B)."*

A further capable SC is again found in the pharmacy, medical and health care sector in which company C operates. The firm is strongly vertically integrated. On the one hand it produces medical products and drugs for the external market in a 'make to stock' manner. On the other hand it manufactures medical machines in a 'make to order' manner. For these machines the company deals with a strong seasonality due to annual budgets while drugs and other products have a volatile demand due to tenders by hospitals. The predictability of demand increases when hospitals or hospital chains are signed in.

> *"On the sales side we are surely more agile while on the production side we are quite lean and the SC has the exciting task to align these two contradicting topics." (Company C).*

Due to the industry in which company C operates, delivery reliability is the decisive factor according to *"the ethical dimension of the industry"*. Availability of products is an externally determined criterion as it saves peoples' lives. Yet price is also an issue.

> *"The main objective is to be always in a position to deliver and the subordinate goal is to be able to offer the products for prices that make sense." (Company C).*

To achieve these objectives, the existing capacities should have a high utilization due to the following reason.

> *"Unused capacities cause higher costs and inefficiencies than adjusting stock volumes, meaning that the main criterion is a stable production and afterwards stock levels are adjusted." (Company C).*

Furthermore, the interviewee explained the importance of stocks and the transparency of the SC.

> *"By having a 'longer SC' for internal customers and by having stocks on several stages, which consist of the clinic, the subsidiary and the main storage, it is possible to build up intelligent mechanisms of knowing where to enter the safe stocks in case supply bottlenecks occur. One can use this transparency of the chain to secure that everybody is served in the end." (Company C).*

However, there is a strong competition, especially abroad e.g. in Asia or Africa. It concerns the question of how much people are willing to pay for quality of treatment. It is perceived differently there than in Western markets. This again leads to the downstream goal of reasonable or lower prices.

The company Bayer is also a pharmaceutical company like company C. Bayer's production is planned according to the vendor-managed inventory principle if applicable. Thus, forecasts from sales affiliates are translated into a replenishment plan. Furthermore, the demand and supply uncertainties are buffered through safety stock. Most of the products are demanded regularly while some have seasonal demand e.g. applicable in case of animal medicine for fleas and ticks or flu products. The customers are wholesalers, hospitals, doctors, veterinarians or directly end customers meaning the patients. Furthermore, customers are segmented according to service levels with A customers receiving a service level of 99%, while B and C customers receive 98% and 97% respectively. These service levels describe how well an order could be fulfilled using the KPI *"on time in full"*. This means that the full order was delivered on time and in the correct amount and quality. Delivery reliability is a key KPI in the strongly regulated pharmaceutical industry. This indicates that Bayer's SC is a capable SC as it offers an added value to the customer. The company has a strategy of keeping safety stocks, comparable to company C's strategy.

> *"For us, delivery reliability is the most important KPI, that everyone who orders, also receives his required products on time in full. In the value chain we have multiple stocks, especially on finished products. We have finished product stock at the manufacturing site, about to be shipped; we have stocks in the*

> *country or region, at the wholesaler and also at the veterinarian, doctor, pharmacist, hospital etc." (Bayer).*

The interviewee explained that it is very important to orchestrate the value chain to avoid bullwhip effects, as the inventory values at the end of the chain are limitedly visible to the pharmaceutical industry. It was stated that it is common for Bayer in the USA but limited in Europe yet.

The electronic corporation company D has a capable SC for spare parts that enables it to offer its maintenance services. The interviewee emphasized the high priority for the availability of the company's solutions and products that are already in operation. It was internally stated that breakdowns or even just downtimes must be avoided at all costs. Otherwise high penalties could be the consequence.

A further capable SC is found with company G, which produces building material and building chemistry while offering a high service level to the customer. The production goes mainly into stock. Additionally, the company offers to order some materials for certain projects. The demand is seasonal with a summer peak. The customers are specialist stores for professionals, not common retailers. Additionally to the product, the company offers technical product consultation, for which a specialized hotline and product training are offered. To receive trainings, customers are invited to the company both in the technical and architectural field. The firm also offers to support projects from the start on. This service factor is one of the strong USPs of the company. This is why it would not reduce service levels in order to reduce costs.

> *"This kind of service is something we place value on and by which we want to differentiate from the competition that sells cheaper products. We have higher-priced products, but also deliver the whole support." (Company G).*

This statement shows that service is an overall part of the company's business strategy, which was also translated into the SC. Besides the service, the products and haulers are of high quality. By offering all kinds of building products, the company strives for high vertical integration. Thus, the company establishes a functioning capable SC. This is further explained in chapter 6.7.1 on the example when the company experienced supply difficulties and which appropriate steps it took afterwards. Delivery reliability is

important for the firm, as customers would switch suppliers if the firm cannot deliver. This leads to the conclusion that the products of the company are exchangeable, but by offering high service levels, it offers a USP to its customers. In contrast to company H and leagile SC strategies, company G does not differ between projects and the usual production, but focuses on the high service for both fields.

Company J also has a capable SC, in this case for chlorosilanes. Regarding this company, two SCs were discussed, of which is one is for functional silanes and the other one is for chlorosilanes. In general company J's operations are vertically integrated from research and development to production and logistics. The logistics of its products and the so-called application technology department, which analyzes the use of its products, are additional services that the company provides. In the following statement the interviewee describes the company's strategy in the recent past just after investing in new facilities.

> *"After all we try to serve as many customers as possible. Despite the complex production structure of most of our products, this is not a problem. The reason is that we have just invested in new production equipment. Consequently, we are rarely in the situation of not having a product available. Of course one has to control the production so that one also has enough supplies* (of raw materials etc.), *which usually works out." (Company J).*

This statement shows that the company manages to fulfill almost all occurring demand due to the investment in new facilities. For the functional silanes the production follows a kind of 'make to stock' approach. To be more exact, the production of functional silanes is discontinuous due to producing different chemical mixes in the same facilities and also to control that the stocks of one kind of silanes do not exceed the available stocking facilities. The special case of functional silanes is that a lot of side products occur during the production for which the company has to find ways to store and sell as well. The customers are usually SMEs. The main issue for the company is the profit generation through functional silanes. However, due to selling them through distributors, the firm loses influence on handling the product.

> *"Yet we have giant problems with the margins of functional silanes. Therefore, we surely try to simplify the chain of logistics to save money. However, the issue here with the functional silanes is that they are often sold by intermediaries and*

> *not directly by the company. (...) They are products that are often delivered to end customers in quantities of kilos and this is not directly managed by us (...)." (Company J).*

In contrast, the production of chlorosilanes is according to demand, meaning a 'make to order' approach. The customers for chlorosilanes are usually big customers.

> *"Regarding the chlorosilanes, the prices are good; we have good margins. For the transportation we use highly specialized containers. These reusable containers (...), we have them designed and built (...). Then we do not choose the cheapest logistics partner, but one of which we know that he is reliable (...)." (Company J).*

Another issue is that company J has invested in new production plants while the economy was in an upward cycle. Yet when the plants start operating, the market of silanes turns into a downturn cycle.

> *"We invested in the plants at a time when the economy was good, but when the plants are finished, at least in the area of the functional silanes, the market of silanes goes down, the demand decreases. Additionally, the competitors have expanded their capacities and the consequence is that the prices collapse." (Company J).*

As delivery reliability is a decisive factor for the company, company J's SC is characterized as a capable SC. The interviewee explains the significance of delivering reliably to the customers in the following quote.

> *"A (interviewer): For example how important is delivery reliability?*
> *B (interviewee): Extremely important, of course. So you can lose the customer relatively easily because most products are interchangeable - there are equivalent competing products. If you established such a customer relationship, which is a longer process, then you can also break the relationship relatively quickly if you cannot deliver. If another competitor captures a business opportunity first, then you cannot return. We also see the reverse case: We take over customers if a competitor cannot deliver. Due to high reliability and ability to deliver, we are able to generate even more business. As an example I can take the chlorosilanes. We have taken away competitors' business at higher prices, which is absurd. Normally you try to get into a market by making price concessions, but we succeeded in doing so because we were particularly good with the supply chain. This is not just the punctual delivery of required quantities, but also the packages* (reusable containers) *in which we deliver, which allow the customer to use this product safely." (Company J).*

Furthermore, delivery speed is a distinguishing factor in the delivery part of the SC. Yet there are huge differences between the two discussed SCs because the functional silanes are a much more complex business.

> *"As we deliver to all parts of the world, we have to be fast. Therefore we are looking for logistic partners, who can transport this special container* (for the chlorosilanes*) to the end customer in a fast way. (...) It is possible for the chlorosilanes because the number of customers is manageable. However, this is not possible for the functional silanes as the bureaucratic complexity would be immense!" (Company J).*

These quotes show that the production of these two kinds of silanes as well as the delivery part to the customer differs significantly due to market requirements: Functional silanes are produced in a 'make to stock' manner and sold through the outsourcing method of distributors. This is a cost-oriented lean approach, which turned out to be a disadvantage for the company in this case because it lead to having less control of the product. In contrast the chlorosilanes are produced in a 'make to order' manner and the company manages the delivery directly. It can be concluded that the functional silanes are managed with a lean SC due to market conditions while the chlorosilanes are using a capable SC. Next, the topic of managing SC risk is discussed.

6.6 Risk-hedging supply chains

Most companies do not have a risk-hedging SC as it is defined in the literature, which claims that this strategy is used under uncertain conditions for the supply while the demand is predictable and stable. For example company E chooses the method of pooling inventory with its milkruns, but does not share costs with other firms. In the following part, the strategies of the examined companies to manage risk will be discussed.

The methods used by the interviewed companies to hedge their supplier risk consist of contracts, stocks, patents and/ or certificates. Certificates of raw material suppliers are inevitable when e.g. producing pharmaceutical products. A further option to reduce disruption risk is to have substitute suppliers as it is the case e.g. for company E, I and Bayer. Company E tries to have one or two substitute suppliers and company H tries to

have at least one substitute supplier for every ingredient. K+S chooses another method, which is hedging risk caused by its limited storage space with target agreements. This is necessary because customers are not willing to commit to binding contracts. Next, for Hochtief the management of its own suppliers consists in securing prices through frame agreements and strategic partnerships:

> *"We are decisively dependent on having secured prices when an order takes place (...) to secure important subcontractors and work jointly with companies from an early stage on. (...) there are special tasks regarding domestic engineering e.g. with building automation and frontage work where there are few firms available. We have to build strategic partnerships from an early stage on as they are crucial for the project's success." (Hochtief).*

Partnerships and collaboration models are also an option for company D. In its case it is challenging to find substitute suppliers. This company has to face supply market conditions that comprise few suppliers in the mobility business. Furthermore, the company has to deal with a lot of regulations, specifications and admission offices. Due to these reasons it tries to define partnerships and elaborate collaboration models with its suppliers by involving them in the developing processes from an early point on. This leads to mutual dependencies, which in turn allows the firm to direct its suppliers during the course of the projects. Yet dependencies on the supplier side bare a risk as in most of the cases financial aspects are contractually fixed and changes in the supply base are difficult, meaning less flexibility.

Furthermore, it is possible to produce the needed materials in-house like company C, H or company J do. Company C conducts make or buy decisions, as it requires small amounts of products, which must have a high quality. Due to this fact the company produces some of its products in-house. Company G has the goal to be self-sustaining and therefore acquires other companies to be vertically integrated. Company K also strives for the approach of vertical integration in order to follow its lean approach, which is further discussed in chapter 6.7.1. The following tables are summarizing the results of the interviews for each company leading to the determination of the supply chain strategy. The following part assesses the effectiveness of the strategies of the interviewed companies.

Table 9: Summary of most important interview results.

Company	**Company A**	**Company A - Subunit**
Production/ Operational setup	make to stock, make to order	demand-related, planned maximum utilization
Demand	seasonal	stable
Customer segmentation	A, B and C according to size of order	A, B and C according to size of order
Service levels	/	/
USP	patents, developments	price, location
Strategies with own suppliers	contracts, stocks	contracts
Focus	/	/
Asset Network	global model	regional model
Type of SCs	lean	lean

Company	**Company B**	**Company C**
Production/ Operational setup	project, make to stock, make to order	make to stock, make to order
Demand	projects, stable	drugs and services volatile, capital goods seasonal
Customer segmentation	fit to technology, potential of projects	internal and external customers
Service levels	/	up to 99%
USP	patents, quality	premium product according to medical parameters, also price
Strategies with own suppliers	contracts, certificate	make and buy, buy: quality insurance agreement, in-house production
Focus	/	vertically integrated in medical sector
Asset Network	regional model	regional model
Type of SCs	agile, capable	capable

Company	Company D	Company E
Production/ Operational setup	make to order, (make to order)	make to stock
Demand	stable	stable, seasonal, promotion
Customer segmentation	majority from public (towns and municipalities) sector, few from private sector	according to size of order, "milkrun" vs. general cargo
Service levels	product/ service/ keyturn ready	delivery in milkruns
USP	develop, manufacture and deliver technologically best mobility, digitalizing, sustainability, longstanding experience with large projects, financial sustainability	high quality
Strategies with own suppliers	partnerships	1 - 2 substitute suppliers, but no splitting of orders
Focus	Europe, countries in need for mobility	Germany
Asset Network	regional model	regional model
Type of SCs	project, capable for maintenance	leagile

Company	Company F	Company G
Production/ Operational setup	make to stock	make to stock, make to order
Demand	seasonal differences	seasonal differences, summer peak
Customer segmentation	10-35 years old, young people	specialist stores
Service levels	young buyer group	product consultation, product training
USP	high quality of ingredients	high quality of products, service
Strategies with own suppliers	stock, forecasts	certificates, production in-house, goal: self-sustaining
Focus	Europe, Turkey	Europe
Asset Network	global model	regional model
Type of SCs	lean	capable

Company	Company H	Company J
Production/ Operational setup	make to stock, make to order	make to stock, make to order
Demand	peaks in February - March and September - October	dependent on market cycle
Customer segmentation	according to market, mostly private sector, public sector (intermediary)	according to industry, customer size
Service levels	creation of control area, introduction for customer	application technology, logistics
USP	commodities--> no difference, thus service and delivery speed	commodities--> no difference, some product patents
Strategies with own suppliers	substitute suppliers for every ingredient	substitute suppliers, contracts, in-house production
Focus	/	/
Asset Network	global model	global model
Type of SCs	leagile	lean, capable

Company	**Company K**	**Bayer**
Production/ Operational setup	"make" to order	make to stock
Demand	slight variations	majority according to forecasts, partly seasonal
Customer segmentation	according to purchased volume	A, B and C according to service levels/ according to kind of customer
Service levels	laboratory services	up to 99.5%
USP	highly engineered, computer-generated data, worldwide in all plants standardized procedures and documentation	high quality given in industry, every product has other USP which differs it from competitor's products
Strategies with own suppliers	standardized barrel size	resources, stocks
Focus	/	/
Asset Network	regional model	regional model
Type of SCs	from agile to lean	capable

Company	**K+S**	**K+S**
Production/ Operational setup	make to stock	make to stock
Demand	seasonal	seasonal
Customer segmentation	wholesalers and retailers (abroad: bigger/smaller distributors)	public, municipalities
Service levels	/	/
USP	"nothing", commodity	"nothing", commodity
Strategies with own suppliers	/	few contracts, target agreements
Focus	Europe	Europe and North America
Asset Network	regional model	regional model
Type of SCs	lean	lean

Company	**Hochtief**
Production/ Operational setup	project
Demand	procurement stable, construction seasonal
Customer segmentation	private and public sector, according to customers' usage
Service levels	from planning, service/ partly or full construction/ turnkey ready/ full operation
USP	high technical knowledge, competence with large-scale projects, ability to structure and undertake complex tasks, lots of offshore know how
Strategies with own suppliers	contracts
Focus	/
Asset Network	regional model
Type of SCs	project

6.7 Conclusion: Alignment and effectiveness of the strategies

In this part the alignment of the companies' SCs with their business strategies and therefore the effectiveness of the strategies is analyzed from an IBS perspective. For some companies the SC is just a consequence of the industry in which they operate. As an example serves K+S where the SC was not set up in a structured process. Instead the SC developed its structure over the years. A number of consultants tried to optimize the SC of K+S, but they did not succeed so far in achieving any significant improvements. The reason is that the factors of seasonal demand, few storage space and location are suboptimal and make the delivery component of the SC extremely challenging.

> *"Here, a lot of people had a tough time with optimization models for the SC because the complexity is so high and because we have evolved structures - we have locations if you could plan them anew these days, they would look totally different." (K+S).*

A further example for the SC evolving from the company's industry is the lean pastry producer company F, which is a typical representative of a food commodities producer. Furthermore, company A and the subunit of company A sell commodities and therefore their needs are best served with a lean SC.

Company D and Hochtief use project SCs, which are needed for a fixed period of time. The distinguishing factor to the agile SC is that there is no SC or facilities in existence and thus a SC has to be established from scratch. This is demanded by the projects on which the firms work. Their business strategy is to fulfill customer demand during a fixed period of time, which requires a high level of agility during a specified duration. Thus, a project SC is the best way to deal with the requirements that result out of the characteristics of the respective industries.

Company E and H have a leagile SC. These companies purposely decided to combine lean and agile aspects to fulfill customer demand better. In these cases the SC is intentionally determined to compete successfully. For company E it is interesting to

further examine if the additional agile part of the SC with the general product haulers generates additional value or if a total focus on milkruns would achieve better results.
In company H there are monthly meetings of quality management to improve the alignment of the strategies continuously. All faulty processes are discussed, including every faulty delivery or customer return. Then theses faults are subjected to decisions according to criteria.

> *"If the criterion is above a certain value, which we determined, a change has to take place in the company. If the criterion is below a certain value, you have to optimize it but not change the process." (Company H).*

Thus company H achieved a delivery quota improvement *"from 92 to 99% in two to three years",* which shows that the firm followed a successful strategy and thus achieved a successful alignment of SCM and business strategy.

Next, company G purposely established a capable SC by implementing its customer service into the SC in order to have a competitive advantage. Company C and Bayer, which are both pharmaceutical companies, also use a capable SC. Here, the companies consciously planned their SCs as well. Delivery reliability is a factor of utmost importance due to the ethical code of conduct and the strict regulations of the pharmaceutical industry. Concerning the topic of aligment of Bayer's SC with the business strategy, the interviewee thinks that this is fulfilled and that the SC can be a competitive advantage for the company.

> *"In certain areas such as consumer health and animal health (...) the SC is definitely increasing competitiveness as we are competing in the fast-moving consumer market. Strong competitors are moving into this segment and they know what supply chain and branding stands for. Not having your reserved shelf space at the drugstore filled will trigger a discussion with the drugstore to remove you out of the assortment." (Bayer).*

Moreover, company D needs a capable SC for its delivery of spare parts due to the high penalties of the industry. Furthermore, company B has established a capable SC for its products underlying GMPs and its over-the-counter products while it also uses an agile SC for its pharmaceutical projects as described above. In this case the influence of the

pharmaceutical industry and the resulting emphasis on the importance of delivery reliability can be determined once more.

The sterilization services of company K also underlie strict regulations. For this firm the SC is a result of striving for a lean profit-maximizing approach. The SC is purposely lean e.g. with features of avoiding additional storage costs.

> *"I would say that the SC is a result of the process because we have to follow the process steps to achieve the correct sterilization. If we enlarge one step only for a few minutes the goods may be unusable. (...) So we have to deliver on time. The second step is that we thought that we could also clock the orders (...). The reason I would see* (for the existing SC) *is to comply with the parameters." (Company K).*

In the following the suggestions for improvement of alignment are shortly discussed. The chemical company A and its subunit had management discussions to identify the SCs, which they have in the company and to find improvements for them. Company A has a customer segmentation according to sales. Customers are categorized into A, B or C customers (A: 80% of revenue, B: 15% of revenue and C: 5% of revenue). Therefore the production is prioritized to fulfill first A's demand and afterwards B and C's orders. This customer segmentation influences the SC. For A customers the production is adjusted because this customer category leads to the most profit for the company. However, the interviewee stated that in his opinion the sales department does not strictly follow this customer segmentation. It was stated that not everybody is aware of the existing customer segmentation, which leads to wrong decisions of the sales department. *"Sales representatives prioritize changes that are not comprehensible (Company A)."* This issue leads to losses in the production. In the opinion of the interviewee, the customer segmentation has to be more aligned with the production processes. Furthermore, the COO of company H has the experience that there was not sufficient alignment of the SC with the sales department. He suggested a higher degree of coordination between SCM and sales departments.

Company J had to switch its strategy for functional silanes from capable to lean due to market requirements. This firm has a special situation as it has to deal with changing market conditions, which force it to take certain measures as described earlier. Here, the

trend of understanding markets better by collecting customer data could play a role. In this case the interviewee mentioned that company J deals with market developments that follow the general economy. Consequently, the question is if the company would have been able use forecasts to foresee the arising problems with functional silanes. As an example, there are lots of indicators for the automobile industry. Thus, arising issues with the functional silanes, which are used e.g. for tire manufacturing, could have been predicted. However, the interviewee stated that he *"would have to speculate (Company J)"* about the usefulness of data collection. Another potential improvement concerns the differentiation from the competition. The interview partner admits that company J does not follow a differentiation strategy with the functional silanes.

> *"With the functional silanes we do not differentiate. One must be quite confident that the demand continues for the next 10 years in order to invest in plants. At that time we were not afraid of competition from abroad because we were technologically and qualitatively so far advanced. It took a downturn with the rubber silanes because everybody could produce them." (Company J).*

The interviewee has the following thoughts about improvement of the alignment of SC and business strategy.

> *"We have a very complex business, where everything is ultimately dependent on each other. The SC in our case is already a very complex structure. You cannot change something easily when having such a wide product range and the multitude of distributors and customers. You can only change something gradually (...). This complexity means that if you change something about the business strategy, it is not simply depicted in the SC." (Company J).*

Furthermore, he states that it is easier to align the SC of the chlorosilanes.

> *"In the case of chlorosilanes it works out because we just want to get into certain markets, which others occupy. Then we just create a dedicated SC and the customer likes it better than the competition." (Company J).*

In the area of functional silanes this strategy cannot be applied because there is much business going through distributors, which allows less influence. Another issue is that the company does not adapt its delivery strategy properly to every country. The individual countries could be tested to decide whether the company should better manage sales and logistics itself or through distributors. This is only discussed and changed in individual cases. Furthermore, the increase of service is questioned shortly,

but the interviewee rejects it as a solution. Instead new kinds of product lines are suggested as a solution.

> *"A: Would higher service levels increase customer loyalty?*
> *B: No, more service would hardly achieve this goal. The provided service is already very sophisticated. We try to build new product lines with which you can generate higher price margins." (Company J).*

Finally, regarding the objective of examining specifically German companies, it can be generally concluded that the examined companies conduct business like other Western firms with sophisticated business strategies and a purposefully applied SCM. The differentiating characteristic in comparison to foreign firms is that thoroughly lean SCs seem to be avoided. At least company F seems to follow the lean approach, which is required when doing business in the commodity market. Yet even K+S, which is also a company selling commodities, offers a kind of additional service in its sophisticated delivery part of the SC. This is underlined by the quote " we select our partners with more than just financial aspects in mind (K+S 2015a)". Furthermore, company A and its subunit do not follow their customer segmentation as strictly as one should follow it with a lean approach. In contrast there is company K, which is managed with a strict lean approach, influenced by its American headquarters. Thus, the firm implements cost-efficiency whenever possible. German companies rather seem to try to differentiate by using capable SCs, which allows them to offer some additional services. The reason could be that a strictly lean approach would also have the consequences of strict cost cutting and thus e.g. of low salaries. This might be hard to align with German labor laws.

Existing studies that examine lean SCs show that companies often implemented leanness due to competitive reasons, which was in Toyota's case the competition with American automakers. Furthermore, HP wanted to compete with Lexmark, Boeing had to react to the increased competitiveness in the airline industry and Barilla competes with other pasta manufacturers in the commodity market. These results allow the conclusion that lean SCs are necessary when a company experiences a high degree of competition. Most of the interviewed companies might not be in such a competitive situation that forces them to apply a strict lean approach. Another influencing element

could be the high long-term orientation of German companies (cf. Hofstede and ITIM International 2016). Therefore, they want to offer some kind of element of customer retention to their clients. However, examining the influence of cultural dimensions on SCM in German companies is a whole new topic. The following table (table 10) gives a short overview of the SC strategy that is used by each company. Next, for further assessment, the changes in the strategies are presented.

Table 10: Companies and their respective SC strategy.

Supply chain strategy	Company
Lean	Company A Company A subunit Company F Company K Company J for functional silanes K+S
Agile	Company B pharmaceutical projects
Project	Company D Hochtief
Leagile	Company E Company H
Capable	Company B GMP and over-the-counter products Company C Company D for spare parts Company G Company J chlorosilanes (past: also for functional silanes) Bayer

6.7.1 Changes in the strategies

In this chapter the changes in the SC strategies over time are discussed. Lean supply chain management can support change management when key processes are redesigned (Kumar et al. 2016: 313). This can be seen on the example of company K. For the last

five years the company has focused increasingly on generating revenue due to guidelines of the American headquarters. In the past company K grew its customer base slowly and was more managed and controlled by the European division. However, the US headquarters changed the policies so that it is focusing stronger on profit generation. This profitability increase was implemented in order to follow the lean approach consequently.

> *"Until five years ago we were lead by the European headquarters. We were a bit self-sufficient as there was a lot of room for interpretation in the regulations. Nowadays the European headquarters are smaller and the key responsibilities are located in the US. Thus, directives are given straight from the US headquarters." (Company K).*

Another change is that the firm is in the process of changing the technical preconditions. Thus, it wants to enable the usage of barrels of sterilization gas from different suppliers in order to be able to react more flexibly. Thus, second sourcing and pressure on suppliers are implemented in order to follow a strict lean approach.

> *"We recognized that we used to depend on certain suppliers (...) every plant was dependent on its suppliers and it was not possible to order gas from another supplier that has different barrels. This is why we are working on a strategy (...) so different suppliers can deliver gas to multiple plants." (Company K).*

The interviewee admitted that service levels are decreased and processes are computerized in order to reduce costs due to the high cost pressure. Nowadays the company's laboratory services and documentation are offered as a supplementary service component. Additionally, company K invested in alternative sterilization technologies in order to follow its lean approach consistently and achieve vertical integration.

In summer 2016 company G experienced supply difficulties due to problems with one supplier, which led to a loss of some projects. This is why it increased its in-house production at one of its European subsidiaries to become more self-sustaining. This has the further consequences of generally increasing the production at the subsidiary plant, meaning an increased in-house production.

> *"We relocated the production to one of our subsidiaries in order to become independent from suppliers. A new recipe was developed and now the subsidiary produces for the own company. Furthermore, the firm wants to integrate a new product in the product range of this plant as the production is not at full capacity yet."* (Company G).

Furthermore, company G wants to increase its warehouse facilities to increase its delivery speed and turnover capacities. This shows again the typical feature of emphasizing delivery reliability and speed when using a capable SC. Capability is important for company G, as it is one of the main USPs of the firm. The company even considers joining administration, technical services and laboratories at one location in the future, which would contribute to the improved alignment of its departments.

Next, the interviewee of company H says that concerning changes, the SC underlies a continual improvement process because it decreases the risk factors of the company relating to costs and product security. The interviewee claimed the following about the future changes for company H.

> *"A: Will the business remain short-term or may it be better predictable in the future?*
> *B: I do not think that it will be more predictable. Let's stay with the corrosion protection, where you are in the project business. There are medium-sized companies, which receive the orders (...). There used to be some large structures, but they do not exist anymore. And these medium-sized companies also live from flexibility." (Company H).*

About forward integration the interviewee stated the following.

> *"It always depends. I would say that there are limits of growth. At some point you reach a certain size and then it all breaks down." (Company H).*

Changes over the years can also be found in the company K+S. In the past the firm emphasized high utilization because the company enjoyed an almost monopolistic position. This had the consequence that the firm sold all of its manufactured products.

> *"The production was not very market-oriented in the past (...). Yet the markets changed over the years, the competition got stronger and substitute products appeared (...)." (K+S).*

Consequently, these days the company improved the sales planning process, which results from the markets and which is consolidated and aligned with the firm's capabilities.

Next, Hochtief had changes in its procurement strategies, which makes sense as it spends more than 60% of its business volume on procurement. Since 2007 "Hochtief Procurement Asia supplies Hochtief subsidiaries worldwide directly with building materials and fit-out elements acquired on favorable terms from manufacturers in China. Hochtief has made this move in response to the rising costs of construction materials and occasional supply bottlenecks in Europe and the US." (Hochtief 2007). Here, the firm has established a vertical integration in order to stay competitive. Furthermore, the company also offers these purchasing services to third parties. Therefore, Hochtief is following a strategy of systematically extending and enhancing its network of international subsidiaries.

Next, the interviewee of company J describes his experiences with change processes as follows.

> *"It has changed a lot. There used to be a lack of these products* (silanes) *in the market and that is why we invested; we were at the capacity limit. We invested and then (...) the market weakens, and at the same time, the competitors have also expanded their capacities. Suddenly this development results in overcapacities." (Company J).*

The company's improvement process goes as follows.

> *"We have projects with external consultants, and wonder how we will proceed further to make money. There are times when we say that we do not want to serve a specific customer anymore because we simply do not generate profit. Of course this decision means that you cannot use your equipment any longer at full utilization. This decision is quite difficult as long as we make gross margins (...)." (Company J).*
>
> *"A: So you would rather change something on the customer side instead of lowering the costs?*
> *B: No, we also have internal projects in order to lower the costs: decrease staff, increase yield, lower stock, (...) streamline the SC abroad, take over our own customers, who have been taken care of by a distributor so far (...)." (Company J).*

However, as mentioned before, these improvements were not assessed systematically.

Bayer's SC mainly changed over the years to become more transparent and therefore to gain *"direction over the chain, which one did not possess in the past."* SC management mainly meant conducting logistics. Bayer saw the opportunity with SC management in having less fixed capital. Furthermore, the firm acknowledged the competitive benefit of a functioning SC as it creates flexibility.

> *"If you orchestrate the supply chain you can better anticipate to changes in the market,e.g. when higher demand of a drug occurs due to an earlier than predicted cold season or you can react when the competitor runs out of stock. If the competition cannot supply the customer we can get in this market quickly." (Bayer).*

Moreover, Bayer Cropscience had a project with Accenture to improve its SC performance with the results of establishing new supply chain organizations and a new global warehouse network (Accenture 2016).

Furthermore, a change process can be found with company C as its website explains that the firm established a global manufacturing department in 2010. The change process lasted several years and was part of an overall supply chain transformation process supported by external consulting. On its website the company claims that during its transformation into a leading renal therapy company, a key success factor is reliability in supply chain performance. Moreover, the SC as a key element supports the growth of the business and at the same time generates cash and thus strengthens the firm for the future by creating an integrated business model and harmonized, cross-company working practices. The global manufacturing department's function is to coordinate all key activities and knowledge transfer and it is responsible for all activities in the SCM (Company C's website – cannot be cited as company wants to stay anonymous). Thus the information obtained in the interview about having stocks on several stages in the SC is a result of this change process. Furthermore, the company claims online that it works on assessing new ways for regions to supply each other in order to achieve a growing efficiency of production. Due to harmonized processes, standardized materials and standardized product components, the firm has the advantages of economies of

scale in production capacities and therefore lower production costs (Company C's website – cannot be cited as company wants to stay anonymous). The interviewee also mentioned decreasing costs as a downstream goal. Furthermore, the interviewee stated that standardized IT systems will support the firm in the future with coordinating activities worldwide. Generally, in order to connect the SC end-to-end, the usage of industry 4.0 is an increasingly important topic. It has advantages like providing immediate availability, instant possibility to adjust demand and supply, and transparency of data. The topic of industry 4.0 will be discussed in more detail in the following paragraph.

6.7.2 Industry 3.0 and 4.0

Finally, there is the question of the current and future importance of automated systems. Most companies acknowledge the importance of automated systems. This chapter informs about this topic. While Industry 3.0 describes the past usage of IT, Industry 4.0 describes the current and future trends of automation and data exchange in manufacturing technologies. The following figure (figure 11) illustrates the terms.

Industry 4.0 in the context of SCM refers to end-to-end cross-linking, which enables a company to fulfill increasingly complex customer demands. The connected SC consists of different smart devices, which communicate with each other (machine-to-machine) without human interference (Bernhard & Litzel 2016). Many new business models just function by using these means. Examples are automated sales and procurement processes, which are supply-demand driven businesses for products of limited differentiation potential. Furthermore, digital channels with broad product portfolios, largely standardized solutions and low touch (customer has no or limited interaction with the sales team) are predestined to make use of industry 4.0 (Schrauf & Berttram 2016)

As described in the previous chapter, industry 4.0 in form of standardized IT systems support company C in coordinating its worldwide activities. Moreover, K+S uses computerized systems in its supply chain portal which is a unified internet-based portal in order to "minimize process costs and reduce lead-times, and to offer an additional

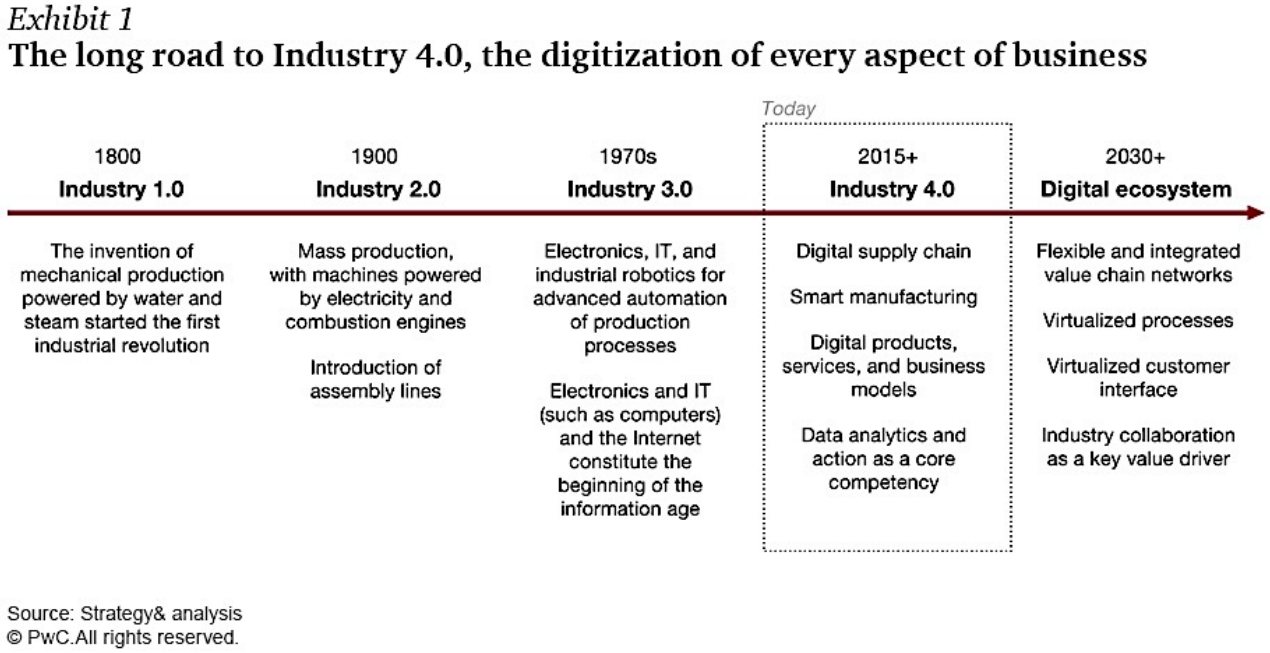

Figure 11: Development of industry 4.0 (Schrauf & Berttram 2016).

benefit to our customers" (K+S 2015b). Furthermore, computerized systems have a high importance in company G especially since it was lately sold to a new parent company. A new inventory control system has been introduced recently to better align the company group's data management. At this point of time there are still issues with the electronic management, which need to be solved to improve the handling.

Regarding industry 4.0 and automation the interviewee of Bayer mentions the sensitivity of medical data.

> *"In our industry, one has data from the end user, meaning from the patient. There exists the problem that you have data that you cannot actually use. For that reason, you have to take the next step to the wholesaler and from there, you can further optimize through the transparency* (of the SC*). " (Bayer).*

However, according to the interviewee's opinion, Bayer's order process is generally already highly automatized. Next, automation means for company J*:*

> *"Of course, we use what is technically available and of course we already track and manage our business with the help of electronic tools. It is not possible to do business successfully without these tools with such a complex business." (Company J).*

> *"We use the tools, but there is no automatism like one sometimes wishes for: Customer orders are received and ultimately no one has to do anything (...). I believe that this is still an illusion, even nowadays." (Company J).*

> *"Customer retention is extremely important in the business with SMEs. For large buyers, who know exactly what they need, (...), I believe it can be a largely automated process. It has been automated already. Dow Corning, which is a large silicone producer, already introduced such a system. This firms sells commodities over the Internet." (Company J).*

This last quote shows that if the customer already knows exactly what to purchase and thus does not require consulting (low touch), industry 4.0 is the right solution. Therefore, commodities and their lean SCs are predestined to have automatic SCs. They can be seen in contrast to customized solutions, services and the related consulting that other groups of customers require.

Finally, the meaning of industry 4.0 can be well seen on the example of company K. In this company the laboratory services related to the sterilization are reduced as much as possible due to digitalization and usage of computerized systems. Furthermore, digitalization supports finding process errors. The company's USP is to be higher engineered than the competition, meaning that it works a lot with computer-based technology, which allows customers to retrieve data about their sterilized products online, including *"the day of collection (Company K)."*. It is a feature that distinguishes this company from the competition.

> *"We can see directly after finishing the sterilization process if the electronic parameters were complied with (...) we can automatically release the goods after parametric checks through software (...) and we can hand the goods over to the customer immediately after the processes are finished. This is a very fast process." (Company K).*

Furthermore, company K works on offering a worldwide standardized way of reporting, thus making it easier for customers to understand the documentation at each one of the company's plants where they sterilize their products.

> *"I like to compare the documentation to McDonald's (...) It is our goal that the customer understands the documentation worldwide no matter at which location his goods have been processed." (Company K).*

For company K, the American headquarters established sophisticated computerized solutions. The successful application of industry 4.0 in the case of company K shows that lean processes can be highly automated.

7. SUMMARY AND CONCLUSION

In this chapter the findings are summarized with a concluding framework from an IBS perspective. Furthermore, practical implications are explained. Finally, the limitations and suggestions for future research are presented.

7.1 Summary of findings

This thesis deals with the topics of business strategy and supply chain strategy. The purpose of the study is to find the advantages, characteristics of alignment and best strategies of alignment. Prior studies have found three main strategies. The first one is the lean SC strategy, which mainly focuses on cost-efficiency and which is used by companies to reduce costs in order to compete on cost-efficiency. Secondly, there is the agile SC strategy, which competes through innovation, differentiation or flexibility. It has the goal to flexibly fulfill customer demand when it occurs. Thirdly, there is the leagile SC strategy, which has the intention to combine the lean and agile aspects to fulfill a basic demand in a cost-efficient way, but also to react flexibly to customer-specific wishes. Most existing studies were conducted in Western countries with medium-to-large-sized companies. However, up until now no study has examined specifically German companies. By the approach of semi-structured interviews the researcher examined medium-to-large-sized internationalized German companies from an IBS perspective.

One result of this study is that basically every company strives to achieve lower costs or costs that are competitive. A further study result is that all interviewed companies either compete on quality or have to comply with high quality standards. Additionally, there is the specialty of strict regulations for the pharmaceutical companies like in the case of company B, C and Bayer. For the final framework it can be assumed that competing on quality can be achieved with every kind of SC strategy manufacturing-wise concerning product quality. However, the topic is different when looking at it delivery-wise. Thus, company H, K+S or company E emphasized the additional quality of their sophisticated

delivery processes. Furthermore, quality can be sold as an additional element, which is exemplified by company K. This firm provides high quality in its sterilization process, but also lets customers pay for additional ‘quality’ in form of laboratory services and documentation. A further examination of companies only competing on quality was not possible because no company chooses this feature in their business strategy solely to align with its SC, but usually offers additional services instead. Furthermore, no company would openly state that its products are of lower quality than substitutes. However, it can be assumed that if a company competes on quality, it should have a whole setup for traceability as described on page 23. This means that in practice concerning the whole SC from the point of sourcing of raw materials to the manufacturing process to the delivery of the product, the customer must receive full transparency of all production steps.

Two interview partners that are K+S and company E emphasized the delivery part of their SC as their main challenge. Generally interviewees elaborated on the functions of plan, source, make and deliver but rarely on the function of return. However, this is a sensitive topic for companies and therefore was not specifically addressed in the questionnaire.

A focus strategy on young people could be found for the pastry producer company F. However, as mostly B2B was examined where a focus strategy is less important, the dimension of focus could not be researched in all depth and no further assumptions can be made about this characteristic. Regarding this topic, further research with more companies operating in B2C is necessary.

In practice the SCs that are described in literature could be validated in practice. Lean SCs are often used in the commodity market as the literature suggests. Furthermore, as the theory describes, they are focusing on the elimination of waste in order to reduce costs in forecast-driven operations with predictable demand. Furthermore, as suggested by Kumar et al. (2016: 313) lean SC management can support change management. This can be confirmed by the example of company K. As lean SCs fulfill the purpose of cost-reduction in commodity markets, the claim of the superiority of the agile SC can be

rejected. For some markets and product categories a lean SC is clearly the preferred choice. Moreover, demand planning and forecasting are crucial elements for the commodity market as it develops alongside market cycles and indicators. For example the steel industry and therefore some of company H's paint products strongly depend on market cycles while e.g. the pharmaceutical industry (company B, C and Bayer) does not as strongly depend on these cycles. In contrast, for specialized products, a close customer relationship is more important than the development of the economy. In these cases detailed knowledge of the development of the specific market for the product is decisive. Moreover, a company's situation depends strongly on market conditions and can become very challenging, as can be seen on the example of company J in a decreasing market

Industry 4.0 is an increasingly important topic. It is already used for lean SCs in the form of automated sales and procurement processes and applied in digital channels. Nowadays the cost advantages of industry 4.0 are most standing out, which can be seen in practice on the example of company K. In future automation and computerization will support the service component of the SC, allowing an end-to-end cross-linking from order to cash. In spite of these gains, there are also limits to this strategy when customer closeness is prioritized to establish relationships with clients. In these cases, SCs supporting customization and a close customer relationship should be the preferred choices.

Superior customer service is the main objective of the agile SC. This kind of supply chain has short lead times that exist in order to react flexibly to unpredictable situations. One agile SC could be validated with company B's pharmaceutical projects. The firm selects projects according to their fit to its technological preconditions. A similar SC strategy is the newly identified 'project' SC. The most significant difference of the agile SC to the project SC is that the project SC has to be created from scratch. This means that for this kind of SC not only new raw materials are needed but the facilities are not available either. Thus, the procurement costs are quite high as can be seen on the example of Hochtief.

Hochtief and the mobility provider company D use the project SC. This kind of SC can be seen as an advancement of the agile SC, used in the case when no SC exists. This is why e.g. Hochtief has to purchse a high amount of required materials. Project SCs must be flexible and agile by nature as projects are custom-tailored. Therefore they are similar to agile SCs with the other distinguishing factor that demand is not as unpredictable as conditions are usually agreed by contracts before the project starts. Furthermore, project SCs only exist during a fixed time frame as executing projects is a temporarily fixed activity.

Leagile SCs could be found for the paint manufacturer company H and the wholesaler of agricultural products company E. For company E a leagile SC refers mainly to logistics in order to act cost-efficiently through milkruns while also to fulfill more flexible demand with product haulers. Company H combines a mix of lean and flexible SCs with different products on the same plant. On the one hand this leagile SC allows the firm to utilize its capacities with products managed in a lean manner. On the other hand an agile SC for the product ‘protective coating’ allows customized mixtures. Thus, the agile part of the SC creates a USP and competitive advantage for company H. Consequently, by using a leagile strategy, company H sophistically and strategically aligned its SCM to support its business strategy in an optimal way.

A capable SC can be seen as an advancement of the leagile SC as a company does not try to fulfill an agile part of its demand in a reactive manner in response to market conditions. Instead a firm chooses a proactive approach emphasizing delivery reliability and speed in order to create a USP and gain a competitive advantage. Basically, the challenge is to deliver additional value to the customer and to differentiate in price-sensitive markets like in the case of company G and J. To add value, the additional service of delivery reliability and speed is added. In the case of company J the additional service for chlorosilanes is the delivery in highly specialized containers and the choice of reliable logistic partners. Company G has the USP to support its customers with service. This emphasis on service was also translated into the firm’s SC. Consequently, company G differentiates from the competition through its customer service by offering trainings and consulting services while having a capable SC. Thus

competing on service is possible with a capable SC, which must be included in the final framework as well.

A capable SC can also be found in the following companies. Company D's SC for spare parts, has to deal with high penalties in case that the availability of its solutions and products in operation is not provided, which requires high delivery reliability and speed. Next, in the case of company B, C and Bayer, the ethical element of the pharmaceutical industry leads to a highly reliable SC. Although customers are cost-sensitive, especially in the pharmaceutical industry, clients pay a premium for reliability. As demand of e.g. pharmaceutical products is usually predictable to some extent, it is possible to offer a capable SC. In conclusion, a capable SC combines a mix of delivery reliability, speed and customer closeness in markets with predictable demand. This means that a functioning capable SC allows high delivery reliability and speed, which in many cases can be the distinguishing factors from the competition, as thee elements allow some differentiation. Thus, the capable SC supports the business strategy and allows slightly increased customer closeness and allows charging slightly higher prices for additional value.

In conclusion companies are more successful and will keep being in a competitive position when business strategy and SC strategy are aligned. The best possible alignment between business strategy and SC strategy depends strongly on the company and its industry, as well as on the market conditions. The three archetypes of lean, agile and leagile SC strategy can be confirmed in practice. Furthermore, the project SC is defined, which can be considered to be an advancement of the agile SC. Next, the capable SC is identified, which can be considered as an advancement of the leagile SC. Thus, competing on quality should also be possible with this strategy. A capable SC can support the business strategy in a price-sensitive environment because it allows adding the differentiating element of service and reliability. By using a capable SC, a business proactively aligns its SCM with its business strategy to create a USP. When looking from an international business student perspective, a capable SC also represents the achievement of a competitive advantage.

Generally German companies utilize similar SC strategies like other Western companies. A differentiating indicator for German companies and their SCM alignment with the business strategy could be avoiding a strict lean approach. It seems that German firms rather choose to compete with a capable SC that offers opportunities of offering some services as additional value to the customer than to strictly reduce costs in a lean manner.

The following table (table 11) summarizes the results in form of a new framework as the conclusion of the study, while also highlighting the adjustments in yellow. Afterwards, practical implications of this study are illustrated.

Table 11: New framework.

Business strategy	**Supply chain strategy**
Cost/ Quality/ Focus	**Lean**
Innovation/ Differentiation/ Flexibility/ Service/ Quality/ Focus	**Agile**
Flexibility/ Customization/ Quality	**Project SC**
Cost/ Innovation/ Differentiation/ Flexibility/ Service/ Quality/ Focus (mix of these strategies depending on each company)	**Leagile**
Flexibility/ Delivery reliability/ Delivery speed/ Quality/ Service	**Capable SC**
FOR MEDIUM-TO-LARGE-SIZED INTERNATIONALIZED (GERMAN) COMPANIES FROM AN INTERNATIONAL BUSINESS STUDENT PERSPECTIVE	

7.2 Practical implications

The question about the practical implications in the future of SCM concerns broadly the field of computerized SCs or in general the tag 'Industry 4.0'. It is for example the idea of automatic reorders, called vendor-managed inventory. This concerns the idea of knowing what the customer wants before he knows it himself. Consequently, the customer will become an integral part of the SC. Cohen and Roussel (2005: 232) claim that more data will be available, and integration of customers and suppliers will be more straightforward due to the continuous improvement of technologies like web-enabled planning and optimization tools. The owner of company H agreed that this trend is growing:

> "B: *If we talk about the commodities and corrosion painting here, the level of integration is not that high, but in the production sectors – agricultural machine manufacturers or car industry, (...) logistics are organized towards the customer.*
> *A: Consequently you have the customer already integrated in the SC?*
> *B: Yes, the customer is a part of the company, if you will. This is of course the ideal case of customer loyalty." (Company H).*

The research showed that for example for company K, computerized systems gained an increasing importance during the last years and supported the company in operating more efficiently by standardizing and speeding up its documentation processes. Company K serves as an example of how working with computer-generated data and digitalization can support business needs. In contrast there are companies like K+S where the challenge of the SC is basically only logistics, which cannot be standardized. Furthermore, the interviewee of company H, who is the owner of a medium-sized company, which could make him biased in this case, thinks that the SC performance depends on the company size.

> *"Large companies are usually dealing with themselves and that has the consequence that their empathy to the market is decreasing. My opinion about this topic is philosophical: Perfection does not exist; there is only the approximation of it. Depending on how the systems are constructed, the larger they become, the farther they get from the approximation." (Company H).*

Here, further research would be helpful regarding the influence of company size on SC

management.

According to literature, future supply chains will firstly enhance productivity. Furthermore, they will also support business-level outcomes by integrating functional strategies and aligning supply chain capabilities and performance objectives with the business strategy. At the same time they will strongly focus on customers and suppliers' needs (Cohen & Roussel 2005: 36 – 37). According to Cohen and Roussel (2005: 232), the next generation SC will have a better alignment of applications with the companies' needs. Furthermore, there will be synergy effects caused by the integration of best practices and effective information systems. However, these developments could also turn out to be simply the price of entry *(*Cohen & Roussel 2005: 236). The three fundamental characteristics could be *transparency, flexibility,* and *simultaneity (*Cohen & Roussel 2005: 233). Next, the limitations and suggestions for further research are presented.

7.3 Limitations and suggestions for further research

One limitation of this study is the small sample size of the interviewees, which means that it would be inaccurate to generalize the study. However, a generalization is not the objective of this research. Future research could investigate the ideas from this study further and apply them to bigger sample sizes in order to confirm and polish the concepts. In general, quantitative measures should be applied to be able to generalize the concepts of how business strategy and supply chain management look like and how they can be successfully aligned. Multiple case studies in global surroundings can be used to validate the framework. This study was only conducted with German companies. Therefore, a broader look on companies from another country would be helpful to make comparisons. These comparisons could also concern cultural influences on SCM. Moreover, the focus of existing studies and of this study is on Western companies or generally companies in developed markets. Thus, it would be interesting to research companies in less developed markets or to try to apply the existing concepts in less developed countries.

A further topic as mentioned in chapter 7.2 is the influence of company size on SC management. Furthermore, supply chain metrics could be examined in more depth. Bayer as an example uses the KPI ‘on time in full’ as mentioned above and the following metrics: Service levels for its customers, sales and forecast performance, inventory levels in value and days on hand, write-off's and reserves, headcount, freight costs and operating costs including storage costs (Biotech Supply Chain Academy 2010). Further information regarding metrics is mentioned in chapter 4.1, researched by Crosdale (2015). The evaluation of the numerical measurement of successful supply chain management can serve as a whole new topic. Another topic of increasing importance is sustainability, which is found for example on most of the interviewed companies’ websites and was sometimes mentioned during the interviews e.g. as an issue by K+S or as a focus of the mobility provider company D. Furthermore, there are plenty of studies regarding sustainability that were recently conducted (Agrawal, Singh &Murtaza 2016; Kumar B.R., Agarwal & Sharma 2016; Sharma & Ghandi 2016; Singh, Rastogi & Aggarwal 2016; Singh & Trivedi 2016; Younis, Sundarakani, Vel 2016). However, researching sustainability of the SC goes beyond the scope of the topic of this thesis and thus was not further examined.

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APPENDIX. Semi-structured interview questionnaire (translated)

Interview questionnaire

General

How do your company's activities in the market look like (5 forces: competitors, suppliers, customers, substitute products) and how do they express in the supply chain?
About what business are we talking?
About which financial range are we talking regarding the revenue?
Which is your responsibility in the company?

Operational structure

According to which criteria is the production planned?
Are there classifications such as make to order, etc.? → Which strategy does the company follow (make to stock/ make to order/ configure to order/ engineer to order)?

Demand, customer requirements

How does the demand curve look like for products?
Does the demand change according to seasons or has other peak times?
Which customer segmentation exists?
Are there service levels and how are they defined?
Would service levels be reduced in order to reduce costs?
Is delivery reliability a key KPIs? / Would customers buy elsewhere if the product does not exist/ the quality is not high enough?

Product

What is the USP of the products?
Do customers require specialized products?

Own suppliers

What strategies do you have so that the company is not dependent on one supplier?

(**Focus**

Is there a focus on a particular segment of the product line, geographic market or buyer group?)

Asset Network

Is the company following a *global model/* producing in one location for the worldwide market?

Or a *regional model/* concerns manufacturing primarily in the locations where the products are sold?

Or a *country model/* concerns manufacturing foremost in the country where the market exists?/ Is the company producing products that cause high transportation costs/duties/tariffs?

Changes

Were there changes of the SC strategy over the years?

Alignment

What are the key criteria and challenges for the SC?

Which improvement took place/ which improvement strategies does the company have?

Is the SC strategy aliged with the overall strategy of the company?

Do you see possible improvements?

Outlook

Industry 4.0: Which meaning do automated/ computerized systems have for the company?

Will there be an increase of using industry 4.0 in the future?

Additional comments

Is there anything you want to add?