
One size does not fit all: an approach for differentiated supply chain management

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Abstract: Supply chain management (SCM) has developed from an object of operational optimisation into a strategic weapon for distinction from competitors. Dynamically changing and strongly varying customer needs demand a differentiated SCM approach. Supply chain differentiation (SCD) plans and designs supply chains based on customer needs, as increasingly demanded by SCM researchers. Therefore, SCD offers a possibility to increase SCM effectiveness. While practitioners are highly interested in SCD, academia has widely neglected this research area and does not offer an integrated approach. This paper presents a framework for SCD that constitutes the first step in developing a holistic procedure for SCD. Based on a comprehensive literature review, a conceptual framework is derived that integrates relevant decision areas of intra- and inter-organisational SCM. By presenting five case studies, we offer further empirical results concerning SCD and validate the framework.

Keywords: supply chain differentiation; SCD; supply chain segmentation; supply chain strategy; sourcing strategy; manufacturing strategy; distribution strategy.

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1 Introduction

1.1 Starting point

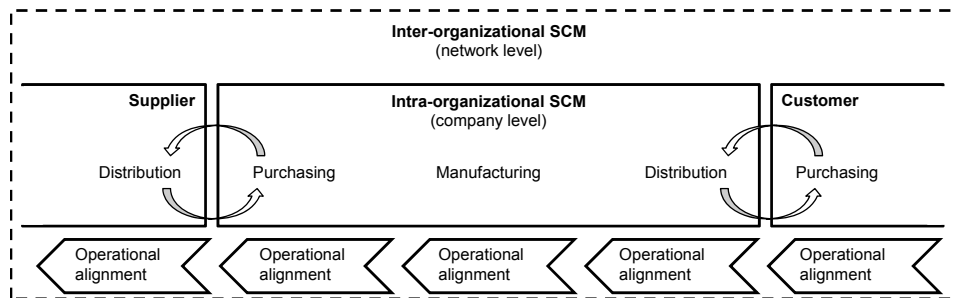
The importance of supply chain management (SCM) has increased over the last decades. Today, whole supply chains (SC) are competing with each other instead of single companies (cf. Christopher and Towill, 2001; Li, 2002). Due to this fact, SCM has become an opportunity for differentiation from competing companies and their SCs. Interestingly, research in SCM has mainly focused on efficiency-oriented topics rather than effectiveness-driven issues (cf. Ketchen et al., 2008; Zokaei and Hines, 2007) or the design of SCs from manufacturing sites downstream, instead of upstream from the customer (cf. Aitken et al., 2005). As established by marketing literature, customer requirements vary more strongly nowadays than in the past. It is apparent, that products and services have to be offered in different and effective ways according to market and consumer requirements. Differing customer requirements – and the fact that SCM is applied as a means of differentiation from competitors – lead to the perception that a ‘one-size-fits-all’ approach to SCM seems to be inadequate (cf. Christopher et al., 2006). Instead of broad and unsophisticated concepts, we propose a differentiated SCM approach.

Supply chain differentiation (SCD) means serving customers according to their needs and requirements, as well as adopting an appropriate SC strategy. From such an effectiveness-driven definition of SCD, two insights emerge: First, a company and its affiliated suppliers and partners may be forced to apply different SC strategies within one business area or market to satisfy customer needs. Second, the SC has to be aligned with the selected SC strategies intra- as well as inter-organisationally. The application of different SC strategies usually implies operating more than one SC to provide similar products or services to different groups of customers, markets or regions.

With respect to differing market requirements, or more specifically product characteristics, there are a number of contributions that aim at identifying an adequate SC strategy given certain market and product attributes (e.g., Christopher and Towill, 2002; Fisher, 1997; Lee, 2002). However, publications that address the subject of how differing customer requirements may be served by applying various SC strategies and configurations at the same time, are rare (cf. Hilletofth, 2009; Hilletofth and Hilmola, 2008; Stich and Meyer, 2009). In particular, approaches that consider the specific requirements of SCM on the company level (intra-organisational) and on the network level (inter-organisational) are not yet available. Intra-organisational SCM (or SCM on company level) is concerned with the SC strategy and the alignment of functional strategies with the SC strategy on company level. This perspective of SCM mainly focuses on cross-functional management of value adding processes within a company. Inter-organisational SCM harmonises SC strategies of single SC partners to a SC strategy

on network level. Thereby, an inter-organisational upstream alignment of functional strategies takes place, and the value adding process on network level is managed. Figure 1 represents the described relationships.

Figure 1 Intra- and inter-organisational SCM



The fact that no holistic approaches are available is even more surprising, since practitioners have already recognised the importance of SCD. For example, Mayer et al. (2009) state that companies applying a differentiated SCM approach are more successful than their competitors that use a 'one-size-fits-all' approach.

The objective of the paper at hand is to present a conceptual framework for SCD that integrates relevant decision areas and supports managers in improving SCM effectiveness to meet varying customer needs. The research question (RQ) we address may be formulated as following:

RQ Which decision areas in SCM are relevant to SCD and which order is adequate for analysing these decision areas?

The framework we present to answer this question aims at configuring the SC based on customer requirements. It thereby guarantees, that the SC planning starts on the demand side and moves upstream to the supply side, as demanded by authors as Aitken et al. (2005) and Christopher et al. (2006). The innovative part of our contribution is the holistic consideration of SCM on the company level (intra-organisational), as well as the network level (inter-organisational). It concerns relevant aspects ranging from the identification of an adequate SC strategy to the operational alignment of the SC, as well as the reflection of interdependencies between the different aspects, while ensuring a competitive degree of SCD.

1.2 Research methodology

The results presented in this paper are the outcome of a research project that lasted from 2009 to 2011. The case selection was conducted by means of theoretical sampling (cf. Eisenhardt, 1989) and identified five companies that were suited to investigate SCD. Besides the five case companies, we integrated two logistics service providers and two SCM consultancies to discuss our results. Within the project we adopted a conceptual deduction as proposed by Meredith (1993). In a first step, a literature review was performed for the description of SCD and the identification of relevant aspects that have to be considered in a differentiated SCM approach. Secondly, a conceptual framework was developed based on the findings of the literature review and the experience of the

involved researchers. Theoretical propositions regarding SCD have been integrated in the framework. In a last step, we compared our theory driven findings with business practice. Through semi-structured interviews with the five case companies we collected data regarding theoretical propositions from the earlier research step. The data analysis followed Yin (2007) and tested the theoretical propositions through the comparison with the empirical findings. If the theoretical propositions did not match empirical findings, we searched for rival explanations (Yin, 2007). To confirm our case study findings, we shared the final case reports with the participants of the case interviews and discussed the findings with experts regarding SCM of two SCM consultancies and two logistics service providers from business practice, according to Hancock and Algozzine (2006).

The paper is structured as follows: after this introduction, we present practical and theoretical relevance of SCD in Section 2. Section 3 introduces our conceptual framework. Empirical findings regarding SCD are presented in Section 4. Section 5 offers a summary of our findings, as well as managerial and theoretical implications.

2 Relevance of SCD

2.1 Practical relevance of SCD

Companies already realised long ago, that guaranteeing various (logistics) service levels is an opportunity for competitive differentiation. However, applying this simple form of differentiation is not sufficient nowadays. Currently, ‘market leaders’ implement more profound approaches. Induced by the concept of ‘mass customisation’ (Piller and Kumar, 2006), new forms of differentiation not only offer different service levels in distribution, but implement differentiated strategies and processes in manufacturing as well as purchasing. These SCM differentiation approaches are often linked with multi-channel distribution systems.

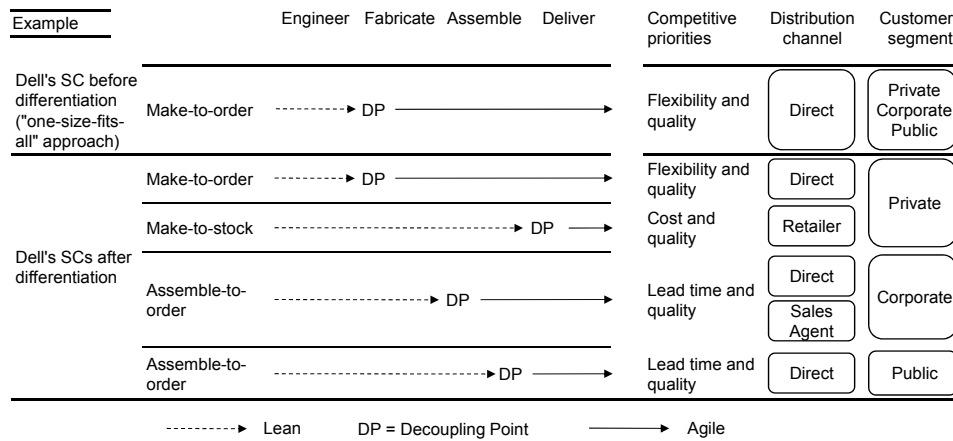
A study of AT Kearney (Mayer et al., 2009) states that companies that apply a differentiated SCM approach are more successful than their competitors using a ‘one-size-fits-all’ approach. Furthermore, two-thirds of the companies that participated in their study have understood the importance of this approach and are working on the implementation of a differentiated SCM approach. It has also been found that 50% of all European companies already differentiate their SC in some form or another (Mayer et al., 2009). Unfortunately the study does not state how the companies differentiate their SC.

McKinsey & Company (Malik et al., 2011) report that SCD “can help tame complexity, save money, and serve customers better”. They present the example of a producer of consumer durables, located in the USA, who differentiates its SC because of highly volatile demand and a large number of product variants.

A further example for SCD is the computer manufacturer Dell, who was known for its negative cash-to-cash cycle, its direct distribution and its make-to-order manufacturing strategy (cf. Fugate and Mentzer, 2004). However, margins have been declining in recent years. Dell analysed the problem and recognised that its make-to-order strategy implied high complexity, which not all customers cherish (cf. Davis, 2010). Figure 2 illustrates possible configurations of Dell’s SC before and after differentiation. The figure only includes certain aspects, such as positioning of the decoupling point (DP), competitive priorities (corresponds to SC strategy), distribution channels and customer segments. Dell

now reports increased customer proximity and lower operational costs (approximately \$1.5 billion cost savings from 2008 to 2010, relative to net revenues of \$61 billion in 2009 and \$53 billion in 2010), which was achieved due to SCD.

Figure 2 Basic principle of SCD (Dell's supposed SCs)



Source: Based on Davis (2010)

Additional examples for SCD are the consumer goods manufacturers Nike, Adidas, and Oakley. All three firms operate a make-to-stock SC that produces their standard products, which are distributed through sport shops and several other channels. In recent years they implemented a make-to-order SC and started offering their customers the opportunity to configure a product according to their wishes, which is distributed directly.

As these examples point out, SCD is a strong upcoming SCM trend in business practice and extends the established concepts of multi-channel distribution, (logistics) service level differentiation and mass customisation. Furthermore, SCD includes the areas of manufacturing and purchasing.

2.2 Theoretical relevance of SCD

SCD is almost as complex as SCM itself, since operating a differentiated SC means having a differentiated SCM. Hilletoft (2009) describes SCD as the possibility to combine different sourcing, manufacturing and distribution strategies for the purpose of developing various SC solutions. Therefore, it is hardly possible to specifically position SCD in SCM research. However, relevant research streams that have to be considered for surveying the state-of-the-art are: SC strategy, effectiveness in SCM and mass customisation as well as SC differentiation and segmentation. Besides these 'core' literature streams, further linked research streams are stated.

2.2.1 Supply chain strategy

One of the first main SC strategies mentioned in the literature follows the 'lean' body of thought. Lean thinking was initially introduced to manufacturing (Krafcik, 1988;

Womack et al., 1990). Lean or efficient SCM is concerned with eliminating all the non-value-adding processes (waste) and thereby minimising costs and cycle times (Hines and Rich, 1997; Hines et al., 1998; Lamming, 1996; Levy, 1997). Shapiro (1984) and Fisher (1997) introduce the discussion concerning physically efficient (lean) vs. market responsive (agile) SC strategies and their relation to product type and business strategy. Further authors contributing to this area are Aitken et al. (2003), Lee (2002), Li and O'Brien (2001), and Mason-Jones et al. (2000a).

Hybrid strategies regarding the application of DPs were the next step of SC strategies mentioned in literature. This concept dates back to Bucklin (1965), who applies it to logistics. Hoekstra et al. (1992) improve the early idea of Bucklin. Naylor et al. (1999) introduce how agile and lean SCs may be combined to create 'leagile' SCs by means of DPs. Leagile SC strategies are discussed by further authors (Bruce and Daly, 2004; Christopher and Towill, 2001, 2002; Christopher, 2000; Mason-Jones et al., 2000b; Mason-Jones and Towill, 1999; Olhager, 2003, 2010; Sun et al., 2008).

The articles in this subsection contribute to SCD since they offer various strategies for SCs and discuss criteria for the selection of an adequate SC strategy given certain product or market characteristics. In addition, the concept of DPs offers a further possibility for tailoring a SC strategy to customer requirements and combining lean and agile strategies. A well deduced and implemented SC strategy is often a competitive advantage. However, SC strategies are only one part of SCD.

2.2.2 Effectiveness in SCM and mass customisation

Efficiency in SCM means doing things right (e.g., cost reduction), while effectiveness aims at doing the right things (e.g., customer orientation and customer service level) (cf. Mentzer et al., 2001; Zokaei and Hines, 2007). Lee (2004) stresses that a pure efficiency focus in SCM does not imply a competitive advantage in today's business environment. He proposes a 'triple A-supply chain' and claims that successful SC are agile, adapt to changing customer and market requirements and aligned with vendors and customers. Zokaei and Hines (2007) claim that a higher effectiveness focus in SCM is required to meet today's differing customer needs. They, as well as Zokaei and Simons (2006), present a method where 'value chain analysis' may be applied to align all the activities within SCM with customer needs. A framework for the integration of marketing and SCM is presented by Jüttner et al. (2010). One aspect of the framework is strategic customer integration, which is concerned with aligning customer needs and value creation with SCM and thereby ensuring the effectiveness of SCM.

The alignment of operations with customer needs and requirements is a key concern of mass customisation. The strong relationship of mass customisation capabilities and relationships in SCM has been pointed out in recent years (cf. Liu and Deitz, 2011). Mass customisation concepts enable companies to provide effectively customised products with almost the same efficiency as a mass production approach (cf. Piller and Kumar, 2006). However, these concepts are restricted to the manufacturing area.

Authors in this area stress the importance of effectiveness and customer-oriented SCM and manufacturing, they also offer instruments for ensuring the effectiveness of a single SC. Hence, they contribute to the above-defined SCD only in a restricted manner and focus on SCM on the company level.

2.2.3 Supply chain differentiation and segmentation

Childerhouse et al. (2002) present a case study of a UK lighting manufacturer that implements four SCs concurrently. They further introduce a framework for the development of 'focused demand chains'. However, the framework focuses on the clustering of products and the assignment of these products to different types of SC by means of the criteria 'product variety', 'demand variability', 'duration of product life-cycle', 'responsiveness of order cycle' and 'product annual demand volume' (DWV3 model). The article of Aitken et al. (2005) is based on the same case study and findings of Childerhouse et al. (2002) and presents seven different generic delivery-focused SC strategies. Christopher et al. (2009) test the DWV3 model in the current business environment and find that the model yields useful hints for the design of differentiated SC. Hilletofth (2009) reports how two Swedish companies have employed differentiated SC strategies. He strongly focuses on manufacturing strategies in the SC context and also considers some aspects of sourcing and distribution. Differentiation with respect to SC processes and their alignment with the SC strategy and product characteristics is studied by Stavroulaki and Davis (2010). However, with the focus on differentiated SC processes they build a bridge for the implementation of differentiated SC strategies, but neglect the development of differentiated SC strategies.

A segmented approach to SCM with a focus on collaboration is proposed by Barratt (2004). In his opinion, strong collaboration should be limited to a small amount of customers and suppliers that are crucial to the company's business. Schnetzler et al. (2006) present a methodology based on axiomatic design decomposition for the development of a segmented SC strategy. In a later publication, Schnetzler et al. (2007) focus on the derivation of a SC strategy applying the same methodology. Stich and Meyer (2009) suggest an approach to SC segmentation based on hybrid systems theory. Godsell et al. (2011) present a methodology they applied with a FMCG producer for the segmentation of its supply chain. They use demand profiling and translate the results into a differentiated SC strategy.

Contributions in this area represent the state of the art in the core research area targeted by this article. The authors combine ideas from supply chain strategy research and the trend towards effectiveness (market) driven SCM. First approaches to design differentiated supply chain strategies are available, but there is a consensus that further empirical research in the form of case studies is necessary (cf. Christopher et al., 2009; Godsell et al., 2011).

2.2.4 Further related research streams

There are several SCD-related research streams. The research topic SCD is related to customer service level differentiation in logistics (service differentiation). Service differentiation is an established approach in logistics research (cf. Gilmour et al., 1976). The basic idea is to vary the offered service level according to the importance of customer segments.

Furthermore, multi-channel distribution research in marketing is linked to SCD. Multi-channel distribution systems are an attempt to offer products to a customer or consumer through different sales channels, through retailers and direct distribution channels for example (cf. Kotler and Keller, 2011).

2.3 Summary of the literature review and research gap

As we have seen, there is a vast body of literature about fitting SC strategies to product characteristics, business unit strategy, demand as well as supply patterns, and customer requirements. However, with respect to SC effectiveness, segmentation and differentiation, the number of contributions strongly decreases.

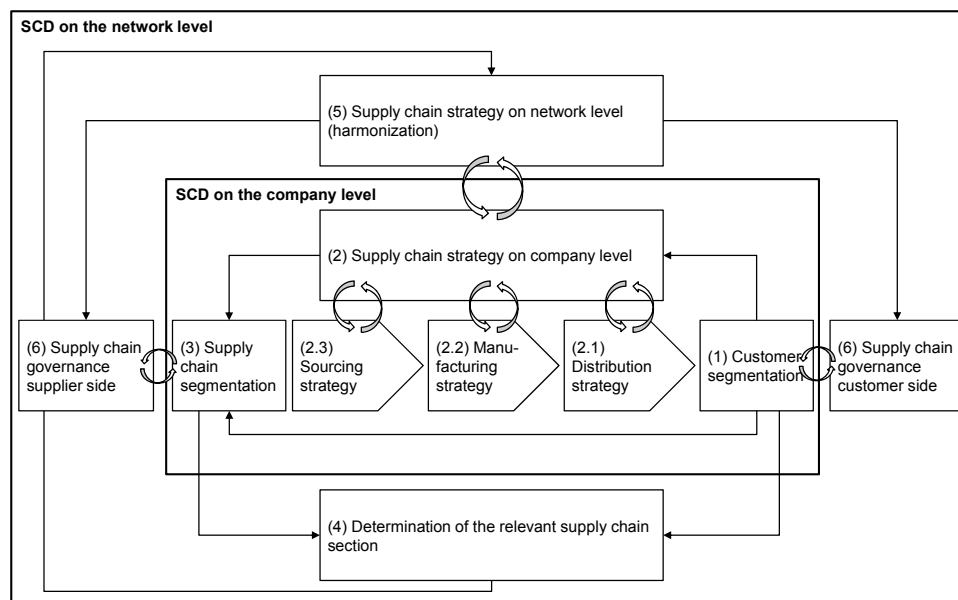
As a number of authors propose, practitioners have an interest in and a need for guidance with respect to SCD. Many aspects that are relevant to SCD are discussed in the respective literature, yet a holistic framework that integrates all these aspects is currently not available in theory. Therefore, the research gap is constituted by the lack of a holistic framework for SCD on the company and network level. In the following section, we propose such a framework and underline the relevant elements.

3 Derivation of a conceptual framework for SCD

3.1 Conceptual framework and triggers for SCD

In this subsection we will introduce a conceptual SCD framework. In theory and practice, frameworks are often used to represent complex relationships (cf. Stavroulaki and Davis, 2010). The objective of our framework (Figure 3) is to give an overview regarding the complex endeavour SCD. The framework supports managers in systematically approaching SCD, since it summarises decision areas relevant to SCD. In addition, we propose a specific sequence for analysing these decision areas, which is represented through the numbering of the decision areas in Figure 3. From a theoretical point of view, the framework constitutes a starting point for further discussions regarding differentiation in SCM and relevant decision areas.

Figure 3 Relevant decision areas for SCD

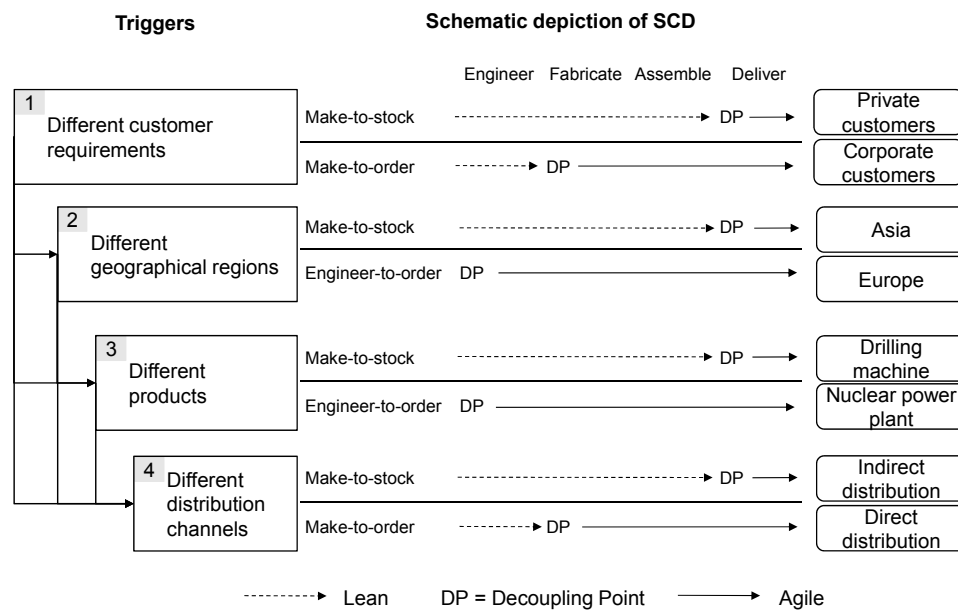


In our research project we identified four different triggers for SCD:

- 1 different customer requirements
- 2 different geographical regions
- 3 different products
- 4 different distribution channels.

The triggers are schematically illustrated in Figure 4 through varying manufacturing strategies and positions of the DP. The relationship between SCD and manufacturing strategy is explained in sub-Section 3.1. The four triggers for SCD are interdependent but in a hierarchical order. For example, varying customer requirements may cause a need for SCD, e.g., if the number of demanded product variants between two customer segments differs strongly. This distinction of customer requirements may be combined with a geographical segregation of the customer segments, e.g., customers in Asia and Europe. Furthermore, differing customer requirements may lead to the introduction of different products and the utilisation of several distribution channels, etc. The hierarchical order is depicted in Figure 4, the superior trigger for SCD is different customer requirements. We will therefore focus on this trigger in the following SCD framework description.

Figure 4 Four triggers for SCD



As explained in the previous section, SCD starts with the customer and designs a segmented SC upstream through the relevant company to its suppliers. Several intra- as well as inter-organisational aspects have to be considered in such an initiative. In the following we will introduce aspects that are relevant to SCD. We start with the company level, hence relevant intra-organisational aspects. In a further step we introduce aspects on the network level and thereby inter-organisational areas that should be considered in SCD.

3.2 SCD on the company level

The SCD framework on the company level is applicable independently from the SCD framework on the network level, since it addresses a company's internal decision areas. However, for an optimal SC design, harmonisation on the network level and therefore with the SC partners is necessary.

3.2.1 Customer requirements and segmentation

The starting point of SCD is the customer and his requirements. Customer and/or market segmentation are the basis for the later SC segmentation. Hilletofth (2011) states that advanced market segmentation capabilities are a key for a demand-oriented SCM approach. Coltman et al. (2010) describe how an analysis of customer requirements and a later segmentation were employed as the basis for a following realignment of DHL's Asia-Pacific operations.

Table 1 Distinguishing attributes for supply chain strategies

<i>Comparison of lean, agile and leagile SC</i>			
<i>Distinguishing attributes</i>	<i>Lean supply chain</i>	<i>Agile supply chain</i>	<i>Leagile supply chain</i>
Market demand	Predictable	Volatile	Volatile and unpredictable
Product variety	Low	High	Medium
Product life cycle	Long	Short	Short
Customer drivers	Cost	Lead time and availability	Service level
Stock-out penalties	Long-term contractual	Immediate and volatile	No place for stock out
Purchasing policy	Buy goods	Assign capacity	Vendor-managed inventory
Typical products	Commodities	Fashion goods	Product as per customer demand
Lead-time compression	Essential	Essential	Desirable
Rapid reconfiguration	Desirable	Essential	Essential
Robustness	Arbitrary	Essential	Desirable

Source: According to Agarwal et al. (2006)

Value-based customer segmentation methods are very popular customer segmentation approaches. Value-based segmentation assumes that customers who demand products in similar price classes or who have similar buying volumes per time unit have similar requirements with respect to products and services. Simple methods for value-based customer segmentation are the well-known ABC or XYZ analysis. Other possible segmentation approaches are based on behaviour, activity or lifestyle (cf. Cooil et al., 2007). However, the objective of segmentation as understood in this paper is not to support sales or marketing but to support SCM. Therefore, customer segmentation has to be conducted with respect to SCM-relevant criteria. Childerhouse et al. (2002), as well as Aitken et al. (2005), use five criteria for building SCM-relevant customer segments (duration of the product life cycle, time window for delivery, annual demand volume,

product variety and demand variability). Basically, all the criteria used for deciding whether a lean or an agile SC approach is more suitable for a market are also criteria for setting up SCM-relevant customer segmentation. Table 1 presents a summary of these criteria.

3.2.2 Supply chain strategy on the company level

According to our perception, a SC strategy on the company level encompasses the design of distribution, manufacturing, sourcing and logistics activities. The core of a SC strategy is its orientation (lean, agile and leagile) and the positioning of a DP. A differentiated SCM approach demands different SC strategies for each identified SC segment. Hereafter, we describe different SC strategies and outline their relation to DPs.

As shown in Section 2, strategic SC orientations can be categorised as *lean* and *agile* as well as their combination, *leagile*. Further, some authors refer to market winners and qualifiers (Christopher and Towill, 2002), also known as competitive priorities (McKone-Sweet and Lee, 2009), for a more specific description of generic SC strategies. The competitive priorities mostly applied to SCM are *lead time*, *quality*, *cost* and *flexibility*. Lead time (which is also referred to as ‘speed’) encompasses the time needed from the beginning to the end of a SC process (cf. Ketchen et al., 2008). Quality refers to SC processes focusing on product reliability and customer satisfaction, whereas an emphasis on cost requires cost-reduction or benefit-enhancing activities. Flexible SCs can rapidly adapt to changing customer needs in terms of both processes and products served. The importance and thereby the ranking of these competitive priorities represents a generic description of SCM’s objectives with regard to the considered market. A summary of market winners and qualifiers for different strategic orientations of SCs is given in Table 2. The SC segments should be designed according to the ranking of competitive priorities of different customer segments.

Table 2 Competitive priorities for different supply chain strategies

<i>Competitive priorities</i>	<i>Lean supply chain</i>	<i>Agile supply chain</i>	<i>Leagile supply chain</i>
Quality	Market qualifier	Market qualifier	Market qualifier
Cost	Market winner	Market qualifier	Market winner
Lead time	Market qualifier	Market qualifier	Market qualifier
Service level	Market qualifier	Market winner	Market winner

Source: According to Agarwal et al. (2006)

For the derivation of an adequate competitive priorities ranking, and thereby SC strategy, three interdependent reference points have to be considered:

- 1 customer requirements
- 2 corporate as well as business strategy
- 3 product characteristics.

A stronger consideration of customer requirements for the derivation of a SC strategy is demanded by a number of academics (e.g., Christopher et al., 2006; Zokaei and Hines, 2007). Since it is the objective of our framework to increase the customer focus, the alignment of the SC strategy with the customer requirements has top priority. For the

segmentation of the customer, an analysis of their requirements is performed. The results of this analysis are now reusable. As proposed by several authors (Hofmann, 2010; Lapide, 2009), the corporate but especially the business strategy should fit the SC strategy. The corporate strategy determines where and therefore in which industries or businesses a company should compete (Grant, 2002). Hence, the corporate strategy influences the number of different business units in a company. Synergies in terms of economies of scale and scope are usually the basis for more efficient manufacturing of products in different business units, which implies that the business units are usually connected to each other. In most cases, every business unit has at least one SC. Therefore, corporate strategy influences the number of different SCs that interact with each other, and with that the configuration of each SC. The business strategy, on the other hand, determines how a company competes in the markets in which it is active. Which SC strategy fits which product type has been very extensively discussed in the literature, as presented in Section 2. Innovative products with high demand volatility require an agile approach with respect to the SC strategy, whereas functional products with low demand volatility fit better with a lean SC strategy. As is apparent, the selection of an appropriate SC strategy is a multiple criteria decision problem. Therefore, instruments like the analytical hierarchy process (Korpela et al., 2001; Saaty, 1994; Wang et al., 2004), analytical network process (Saaty and Vargas, 2006), the aggregated indices randomised method (Hovanov et al., 2009) and means-end models (cf. Montibeller et al., 2008) are suitable for solving this decision problem. A literature survey of multiple criteria decision making in SCM is given by Beck and Hofmann (2012).

A further crucial design variable for SC strategies is the positioning of *DPs* within the SC. The customer order decoupling point, sometimes also referred to as the order penetration point, is the position in the material flow where the product is linked to a specific customer order (cf. Olhager, 2010). *DPs* separate the lean-oriented parts from the agile-oriented parts of a SC and thereby form a *leagile* SC. The positioning of the *DPs* within a SC depends strongly on the customer requirements and the chosen strategic orientation. If the demand variability is high, the SC has to be flexible rather than cost-efficient. In such cases the *DP* is positioned upstream in the supply chain. In cost-efficient SCs, on the other hand, the *DP* is positioned downstream. Approaches to positioning a *DP* may be found in Olhager (2003) and Sun et al. (2008), for example.

3.2.3 *Linking functional strategies to the supply chain strategy*

Functional strategies can be categorised into two classes:

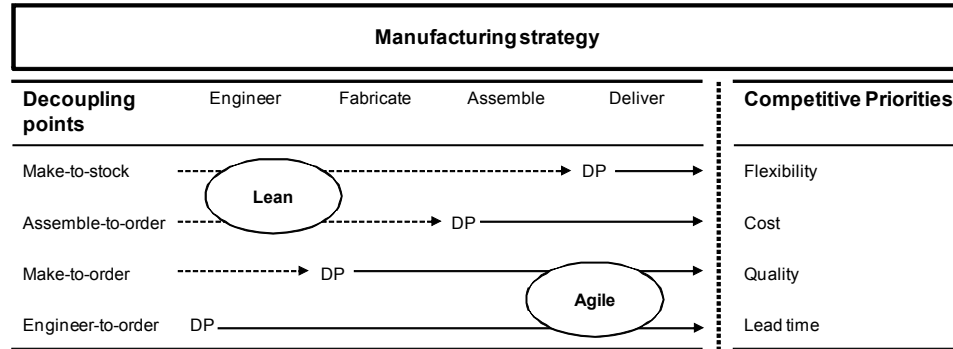
- 1 directly related to the value-adding processes like sourcing, manufacturing, distribution and logistics strategies
- 2 strategies of supporting activities, e.g., marketing, IT and R&D.

Functional strategies have to be aligned with the business unit strategy (Grant, 2002). Chopra and Meindl (2007, p.23) state a strong interrelationship between the SC and the functional strategies. According to Hofmann (2010), this strong interrelationship is also represented in the literature on SC strategies. Hence, adopting adequate functional strategies according to the SC strategy is crucial for SCD. The most important functional

strategies for SCD are strategies directly related to the value-adding process. Therefore, we only consider these strategies.

The *distribution strategy* has to be tailored to the customer segment under consideration. The first tasks in this area are the determination of adequate 'customer interaction models' as well as their corresponding distribution channels and design, i.e., deciding whether a product is directly or indirectly offered to customers (cf. Kotler and Keller, 2011). Depending on the product characteristics and price, these tasks clearly represent an interface of SCM to marketing, but are mainly core activities of marketing departments. While in business-to-business markets direct delivery is common, consumer goods can pass through several channels, e.g., single-stage (retailer) or three-stage (agent, wholesaler and retailer) channels. The logistics strategy strongly depends on the distribution channels and the customer needs that have to be met (cf. Chopra, 2003). For example, the utilisation of either direct or indirect shipments or the employment of hub and spoke systems or cross-docking solutions depends on the desired distribution channel. Transportation modes (rail, ocean, road or air) also strongly depend on the regarded distribution channel. Additionally, every utilised distribution channel has different implications for customer relationships and information sharing, which will be discussed in the following section.

When regarding companies with value creation (commercial enterprises differ on this issue), a *manufacturing strategy* has to be chosen for each SC segment with respect to customer requirements and the distribution channels served. The manufacturing strategy probably has the strongest relationship to the SC strategy. It is also often described in terms of competitive priorities. Dangayach and Deshmukh (2001) conduct a literature review of 260 articles on manufacturing strategy and identify five competitive priorities: *cost* (production and distribution of products at low cost), *quality* (manufacture of products with high quality or performance standards), *delivery dependability* (meet delivery schedules), *delivery speed* (react quickly to customer orders to deliver fast) and *flexibility* (react to changes in products, changes in product mix, modifications in design, fluctuations in materials, changes in sequence). Other authors mention only four competitive priorities for describing manufacturing strategies, i.e., *cost*, *delivery*, *flexibility* and *quality* (cf. Amoako-Gyampah and Acquah, 2008). Apparently, these competitive priorities are closely related to the competitive priorities in SCM. Hence, competitive priorities for describing a manufacturing strategy are derivable from the strategic orientation of the SC or are even identical. As a consequence, the ranking of competitive priorities derived from customer requirements, as described above, also serves to determine an orientation for a manufacturing strategy. A further considerable component of the manufacturing strategy is the concept of postponement, introduced to academic discussions by Bucklin (1965). Strong demand for customised products and a difficult forecasting of customer demand have intensified the importance of postponement in manufacturing (cf. Kumar and Wilson, 2009). Postponement means delaying the decision concerning the final configuration of a product and is accomplished by positioning a DP upstream in the SC. Therefore, the positioning of a DP in the SC and a possible postponement strategy in manufacturing are basically the same decision. A further aspect in this area that needs to be considered is intra-firm logistics. For example, the transportation modes between different manufacturing locations must be determined, as well as the positioning of warehouses. Figure 5 summarises the discussion above.

Figure 5 Considered components of manufacturing strategy

Source: Based on Olhager (2010) and
Amoako-Gyampah and Acquah (2008)

The *sourcing strategy* within a SC segment refers to a differentiated approach concerning suppliers. Cousins and Spekman (2003) state that strategic relationships with a limited number of key suppliers enhance the competitiveness of the whole supply chain. It is therefore crucial to identify which suppliers are of what importance to a company and its supply chain and to implement adequate sourcing approaches with respect to each segment. Popular ways to derive sourcing strategies are portfolio models for supplier segmentation. One of the first portfolio models in sourcing was created by Kraljic (1983). The model categorises suppliers into four classes with regard to the supply risk and profit impact of the provided products and suggests generic supply strategies for each class of supplier. Several authors refine and improve this model, for example based on the power and dependence of the supplier and buyer. Gelderman and van Weele (2003) deduce nine generic purchasing strategies, at least two for each quadrant of Kraljic's model. Another framework for a differentiated sourcing approach that ranges from supplier selection to supplier assessment and development is presented by Park et al. (2010). Further decision variables that have to be considered while establishing a sourcing strategy are the location of the supply markets (domestic procurement, foreign procurement, global procurement, etc.) and the target number of suppliers of a primary product (single, dual or multiple sourcing). Additionally, inbound logistics need to be aligned with the sourcing strategy. It has to be decided where the warehouses are located, which transportation modes are utilised and what kind of concepts are appropriate, like just-in-time, just-in-sequence or consignment warehouses.

3.2.4 Supply chain segmentation

SC segmentation is mostly based on the previously conducted customer segmentation and the distribution channels used per customer segment. The combination of customer segments and distribution channels leads to segments with different competitive priority rankings. Therefore, strategic SC orientation, the positioning of the DP and the functional strategies will vary between the different customer segments and distribution channels. The task within SC segmentation is to set up different SCs that are designed according to these strategic orientations and that use synergies between each other if possible.

Childerhouse et al. (2002) describe how their case example segmented its supply chain with respect to the different resources and core competencies available to the company.

3.3 SCD on the network level

Inter-organisational SCD aims at an alignment of the SC strategy and governance with key SC partners within each SC segment. The inter-organisational framework presented in this subsection, can be taken as an extension of the intra-organisational framework in the last subsection. The SC network strategy determines the content of relationships, network structures and harmonisation of network objectives (structural components) on the one hand, as well as the combination of resources via cross-company processes and projects (dynamic components) on the other hand.

According to Halldorsson et al. (2007), one fundamental assumption of the network perspective says that the individual firm depends on resources controlled by other firms, but it can gain access to these resources by interacting with other firms. The relationships between individual companies are developed through exchange processes (including exchange of information, goods and services, social processes, etc.) and adaptation processes (mutual modifications of products, processes, etc.). Networks have a dynamic nature and are in a constant state of movement and change. Another network characteristic is its power structure, illustrating which powers or capabilities the partners possess and how they are employed to influence the actions of other actors within the network. The power structure thus also determines the role and position of the individual firm in relation to other firms in the network (cf. Cox et al., 2001).

3.3.1 Determining the relevant supply chain section

A differentiated SCM necessitates the identification of the relevant SC section for each SC segment, since analysing the SC configuration on the network level does not investigate the individual companies, but rather a particular SC section containing several companies. The relevant SC section is comprised of key partners within the SC.

From the perspective of a single firm, its relevant SC section consists of customers and suppliers that are classified as important or valuable in the segmentation. Key customers and suppliers belong to its relevant SC section and have to be integrated in a harmonisation process. Moderately important customers and suppliers have to be partially integrated according to their involvement in the value-adding process. Unimportant customers and suppliers are not integrated in a harmonisation process. A possible criterion to determine the partners that have to be integrated in the harmonisation process is the 'value of goods sold or purchased' (ABC analysis). The basic assumption of this proceeding is that more valuable A-goods are of greater importance to the final product, and therefore the SC partners providing or buying these goods are key suppliers or customers. For example, partners that deliver or purchase A-goods should be integrated, partners that deliver or purchase B-goods should be partially integrated and C-goods partners should not be integrated.

3.3.2 Supply chain strategy on the network level

The harmonisation of the SC strategy on the network level is a rather difficult task, since each firm has its own strategic view of its role in the SC. However, for key partners

within the SC, the focal firm determines the strategy of the network to some extent with its corporate and SC strategy [cf. Hofmann, (2010), p.267]. Single firms that are not focal in the considered SC have to regard their position and integration in different networks [cf. Hofmann, (2010), p.267]. For such firms it is possible to be part of multiple competing SCs, which may have different strategic orientations. In these cases a differentiated SCM approach is particularly useful, since one SC segment of the regarded firm may provide primary products to one SC section with a specific strategic SC orientation, while another SC segment of the firm may provide primary parts to another SC section to which the firm belongs, which has a different strategic SC orientation.

Harmonisation of the SC strategy on the network level is possible through aligning the partners in the SC section toward a common ranking of competitive priorities (*costs, flexibility, quality or lead time*). The extent of harmonisation between partners' strategies is discussed by means of the subcomponents' ABC classification, which was mentioned earlier.

From a value perspective, 'A' components are considered first. They have the highest monetary value for the end product and thus also for the end customer. Therefore, the 'A' component SC should be fully aligned and harmonised. We could, for example, look at a SC oriented towards *flexibility* and *lead time* on the network level. If an 'A' subcomponent supplier is specialised in costs and flexibility, the availability may be ensured, but the rest of the SC is not able to adapt quickly enough to a changing market and end customer demands. This might lead to out-of-stock or excessive stock of unwanted components. As the example shows, 'A' component suppliers should adapt their SC strategy to the network strategy, while other differentiation criteria, such as the inventory level, are less important because they automatically adjust to the strategy. 'C' components, however, account for less of the total value, but make up a higher total share of the item. 'C' components are either mass-produced goods (e.g., screws) or components that support the material flow and production process (e.g., work uniforms). They are usually standardised and take up less capital commitment. Due to rather stable demand, the risk of mistakes in inventory planning is relatively small and they usually do not have to be strategically aligned with the end product. 'C' components can be classified as consumption-steered parts (depending on the periodical need) and should be attained as cost-effectively as possible. For 'B' components, a situational approach is required, depending on whether they are more oriented toward 'A' or 'C' components.

If the network-level SC is geared toward flexibility and quality or lead time, a subcomponent with high inventory levels or very predictable demand does not have to be oriented toward flexibility (already ensured through inventory/predictability), but instead toward cost or quality. In doing so, it benefits the entire SC and its end product.

Harmonising a hybrid SC (costs plus flexibility focus) involves determining which agents have an efficient SC and which have a reactive one as well as positioning an inter-organisational DP. Within the reactive or efficient part, subcomponents can be sourced according to the 'ABC' differentiation criteria. Ideally, the degree of postponement is aligned with the SC goals and collectively determined by the agents. On the network level, not all DPs are on the same level of value creation.

3.3.3 Supply chain governance

The SC governance structure has to be chosen according to the importance of the SC partners, but also with respect to the balance of power between the partners. Implications

for the harmonisation of SC governance on the network level stem from the classification of customers and suppliers in the previous subsection or the above-utilised ABC classification.

The issue of supply chain governance subsumes governance structures itself, but also extends to decision areas like relationship management and information sharing. SC governance encompasses the coordination mechanism regarding SC partners. Gereffi et al. (2005), by referring to transaction cost theory, state five different types of governance structures in SCs, which can be used to describe different types of structures and interaction between agents on the network level:

- 1 *markets*: transactions have low complexity and are easily codified; capabilities in the supply base are high
- 2 *modular chains*: transactions have high complexity and are easily codified; capabilities in the supply base are high
- 3 *relational chains*: transactions have high complexity and are difficult to codify; capabilities in the supply base are high
- 4 *captive chains*: transactions have high complexity and are easily codified; capabilities in the supply base are low
- 5 *hierarchy*: transactions have high complexity and are difficult to codify; capabilities in the supply base are low.

The degree of explicit coordination and power asymmetry in the network spans from low (markets) to high (hierarchy). Once an appropriate SC governance structure has been identified, coordination mechanisms have to be chosen. Dependent on the governance structure, possible coordination mechanisms are price (markets and modular chains), trust (modular, relational and captive chains) as well as instruction (captive chains and hierarchy).

A topic that has to be decided within the context of SC governance and harmonised on the network level, is the kind of relationship that is aspired to, e.g., transactional, arm's length, partnership or strategic alliance. Apparently, transactional relationships are hardly convenient in relational chains. Therefore, the relationships have to be harmonised according to the type of SC governance structure selected.

Additionally, the decision field of information sharing strongly depends on the chosen SC governance structure and the aspired-to relationship. Managers have to decide what information they will share, to what extent and at which time intervals.

4 Empirical findings

4.1 Description of case studies

In this section, we present the results of five case studies conducted from 2009 to 2011. The case studies integrated five differently sized Swiss companies from different industries. Table 3 presents a description of the case companies. The unit of analysis was the whole company except for case 4. Case company 4 is a strongly diversified company, which is why we analysed a specific business unit in this case.

Table 3 Description of case companies

<i>Case</i>	<i>Number of employees 2011</i>	<i>Revenue 2011</i>	<i>Geographical scope</i>	<i>Industry (NACE description)</i>
Case 1	150	N/A	Switzerland and Germany	Manufacture of other machinery and equipment
Case 2	250	85 MM US \$	Multi-national	Manufacture of other general-purpose machinery
Case 3	600	210 MM US \$	Multi-national	Manufacture of communication equipment
Case 4	9,000	2,500 MM US \$	Global	Manufacture of machinery for food, beverage and tobacco processing
Case 5	4,000	3,000 MM US \$	Global	Operation of dairies and cheese making

Note: Rounded figures.

4.2 *SCD on company level*

The following brief description of SCD on company level regarding the case companies, is structured in accordance to the framework presented in sub-Section 3.1. Table 4 presents the information gathered in the case companies.

4.2.1 *Customer requirements and segmentation*

All case companies stated that they review customer requirements and occurring changes on a regular basis. The resulting customer segmentation has implications on the case companies' operations management. The segmentation of the case companies is mainly based on value and volume criteria regarding demand (case 1 and 5). Case companies 2, 3 and 4 furthermore integrate differing technical requirements of their customers, which occur jointly with a geographical separation of their customer segments in cases 2 and 4.

The regarded case companies use purely marketing-oriented customer segmentations for the differentiation of their SC. Certainly, the consideration of demand volume and technical requirements (which is interdependent with the number of required product variants) are criteria with implications on SCM. However, a further integration of SCM relevant criteria like proposed by Childerhouse et al. (2002) and a more SCM focused customer segmentation might be advantageous.

4.2.2 *Supply chain strategy on the company level*

The competitive priorities of the different SC arose from customers' requirements in the different segments. However, the competitive priorities have not been analytically derived. Therefore, the SC strategies of the regarded case companies could rather be described as emergent than intended. Especially in case 5 the question arises, whether the operation of two SC with the same strategic orientation equips the company with any competitive advantage.

Table 4 SCD on company level in the regarded case companies

Case	Customer segmentation	Supply chain strategy on company level				Supply chain segmentation
		Competitive priorities	Distribution strategy	Manufacturing strategy	Sourcing strategy	
Case 1	Key customers	1 Quality	• Direct distribution	• Make-to-stock	• Dual sourcing	Historically induced
		2 Flexibility	• Stock keeping at production side • Service level agreement	• Engineer-to-order	• Special suppliers for engineer-to-order projects	
Case 2	Small customers	1 Costs	• Direct distribution	• Make-to-stock	• Dual sourcing	Specific decision to segment supply chains
		2 Quality	• Stock keeping at production side			
	Europe	1 Quality	• Direct distribution	• Make-to-order	• Dual sourcing	
		2 Flexibility	• Immediate delivery after completion of machines	• Engineer-to-order	• 95% sourced in Switzerland, 5% in Asia	
Case 3	Asia	1 Costs	• Direct distribution	• Make-to-stock	• Dual sourcing	Specific decision to segment supply chains
		2 Lead time	• Short stock-keeping of completed machine		• 25% sourced in Switzerland, 75% in Asia	
	Private	1 Lead time	• Multi-sales channel model	• Make-to-stock (80%)	• Global sourcing approach with sourcing platform in Asia	
		2 Quality	• Decentralised warehouses	• Make-to-order (20%)	• Supplier segments: preferred, approved, monitored	
Case 4	Public	1 Flexibility	• Distribution through system integrators	• Make-to-stock (20%)		Historically induced
		2 Quality	• Direct delivery	• Make-to-order (80%)		
	Top-markets (mainly Europe and USA)	1 Quality	• Direct distribution and delivery	• Make-to-order	• Sourcing mainly in Europe	
		2 Flexibility		• Source-to-order • Engineer-to-order		
Case 5	Mid-markets (mainly Asia)	1 Quality	• Direct distribution and delivery	• Assemble-to-order	• Sourcing mainly in Asia	Historically induced
		2 Costs		• Source-to-order		
	A-customers	1 Lead time	• Direct distribution and delivery	• Make-to-stock	• Local sourcing	
		2 Flexibility	• Service level differentiation, however high service level	• Make-to-order • Engineer-to-order		
	B- and C-customers	1 Lead time	• Direct distribution	• Make-to-stock		
		2 Flexibility	• Decentralised warehousing and delivery • Mid to low service level			

Furthermore, the lack of a more SCM-focused customer segmentation may lead to a strategic misalignment of the differentiated SC. Additionally, only case company 3 stated a regular review of their strategic orientation on a yearly basis.

4.2.3 Linking functional strategies to the supply chain strategy

When considering functional strategies within different SC, it becomes apparent, that especially distribution and manufacturing strategies are differentiated and tailored to the competitive priorities in the different SC. In the distribution area, the main difference is whether final products are stored or not. Naturally, this is strongly interdependent with the applied manufacturing strategy. An interesting fact regarding manufacturing strategies in the differentiated SCs of the case companies is that often several manufacturing strategies are applied within one supply chain. Possibly this might be regarded as a further SC differentiation.

Three of five case companies also differentiate their sourcing strategy in their different SCs. In cases 3 and 5, no differentiation in the sourcing area was observable. This finding is coherent with the findings in Hilletoft (2009).

4.2.4 Supply chain segmentation

Only in two of the five cases clues were observable that indicated a specific decision to segment (or differentiate) the supply chain. Three case companies operate a differentiated SC due to historical reasons.

4.3 SCD on network level

The perception of SCM varies strongly between the case companies and spans from an integrative approach for distribution, manufacturing and sourcing to the notion that the single consideration of the sourcing area is synonymous to SCM. Overall, SCM on network level is not well established in the regarded case companies. The approach in this area is restricted to relationship management. Table 5 summarises the results of the case studies.

4.3.1 Determining the relevant supply chain section

None of the case companies actively determined their key partners in their SCs. The case companies identified which customers and suppliers are crucial to their success by means of a customer or supplier segmentation. However, a group of customers or suppliers that is integrated in their planning process or strategy review, was not identified by the case companies.

4.3.2 Supply chain strategy on the network level

Only case company 2 and 5 harmonised their SC strategies with their customers. However, the information gathered in these cases indicated that these harmonisation is due to the historical nature of their relationship. Therefore, the observed SC strategy harmonisation is purely emergent.

Table 5 SCD on network level in the regarded case companies

Case	Determination of relevant supply chain section	Supply chain strategy on network level	Supply chain governance	
			Customer side	Supplier side
Case 1	According to customer and supplier segmentation	Not harmonised	Differentiation in information exchange between customer segments	No differentiation
Case 2		Harmonised with customer side	No differentiation	No differentiation
Case 3		Not harmonised	Differentiation in information exchange between customer segments	Differentiation with respect to information exchange and duration of relationships regarding supplier segments
Case 4		Not harmonised	No differentiation	No differentiation
Case 5		Harmonised with customer side	Differentiation in information exchange and relationships between customer segments	No differentiation

4.3.3 Supply chain governance

The implementation of a differentiated SC governance varies strongly between the case companies. Case companies 2 and 4 do not differentiate their SC governance structure at all. Case company 1 and 5 differentiate their governance structure with respect to the customer side. Only case company 3 operates a differentiated SC governance approach with respect to the customer and supplier side.

5 Conclusions

In this article we present a framework for SCD. The main concern of the framework is to design a SC or, if necessary, multiple SCs upstream starting from the customer and to introduce relevant decision areas. It is the output of a long-term research project that integrated five case studies.

From a theoretical perspective the idea of SCD is not new. For some years already, academics have claimed that a segmented or more differentiated approach to SCM will be the future in this field (e.g., Aitken et al., 2005; Childerhouse et al., 2002; Christopher et al., 2006). However, research has widely neglected this topic (cf. Hilletofth, 2009) and no holistic framework for SCD is available. This article offers such a framework. It contributes to theory by presenting relevant SCM decision areas and advancing the SCD concept of Hilletofth (2009). Moreover, the article provides further empirical results regarding SCD.

Concerning the practical contribution, our framework offers support for managers in approaching SCD. The framework states which decision areas should be analysed, interdependencies between these decision areas and a specific order for analysing these

decision areas. Furthermore, for each decision area, possible analyses are quoted or publications are cited that offer potential insights. Additionally, the article points out that the concurrent operation of several parallel SCs offers potential for increasing competitiveness. The paper also emphasises the strategic importance of SCM.

5.1 Managerial implications

From a managerial point of view, the application of the framework and thereby SCD, bears several advantages. First, SCD ensures that SCs are planned and designed based on customer requirements instead of focusing on a company's internal operations as the foundation for SC planning and design. Through this, customer proximity may be increased, since they are served more specifically with respect to their requirements. Second, as our case studies indicate, SCD offers a possibility to improve effectiveness while increasing SC efficiency. This statement is supported by the practical example of Dell (cf. Davis, 2010). Furthermore, Mayer et al. (2009) survey 150 European companies and state that the participating companies that apply SCD (segmentation) have lower logistics costs and deliver a higher proportion of their orders on time on average. But SCD is still associated with a number of challenges. It is a long-term endeavour that involves the whole company and therefore demands several cross-functional teams. Furthermore, certain organisational changes might even be necessary for implementing SCD. In addition, it takes a lot of resources, requires top management attention as well as support and demands various different capabilities (e.g., profound skills in customer analysis, as well as the derivation of SC goals from customer requirements and well-trained project managers).

5.2 Limitations and future research directions

Summarising the case study results, it is observable that our proposed framework on company level integrates central aspects of SCD, which are coherent with the differentiation adopted by the case companies. However, since our research is restricted to five case studies, it is possible that not all relevant decision areas are integrated in the framework. Regarding SCD on network level, we observed that the case companies have not integrated these aspects in their differentiation. Hence, the question arises if these aspects are relevant from practical point of view.

Since the aim of the framework is to offer a holistic approach to SCD, the level of detail for individual considerations is rather low. For example, the interdependencies between single decision areas should be investigated more closely and the segmentation of the SC needs further research for the derivation of design suggestions from a theoretical point of view. This is especially important when coming to the alignment of the SC strategy with the distribution, manufacturing and sourcing strategy, as well as the implications for customer and supplier relationship management. Furthermore, the framework is based on a comprehensive literature review. Therefore, the incorporated decision areas are focused on issues that are well investigated in the literature. Despite the collaboration with practitioners from varying industries to improve the presented framework, further test cases are required to ensure that all the relevant aspects are covered and that further validation and enhancement of the framework take place. Clearly these shortcomings are resolvable through further research concerning interdependencies between different decision areas as well as the completeness of the framework for SCD.

Besides these aspects, several further fields of study arise in connection with the framework. For example, it is questionable how a company should be organised if it applies SCD and how the segmentation of the SC should be performed. Should there be a strict physical segregation of different SCs or might different SCs even function using joint manufacturing facilities? Therefore, further research should be dedicated to the implementation of SCD. Additionally, the question about which criteria determine whether two SCs within the same business unit of a company should be completely segregated or not comes up. Since there is not much knowledge available on this topic, exploratory research is needed for the exact description and formulation of hypotheses about this phenomenon. The mentioned positive effect of SCD on SC performance (effectiveness and efficiency) should also be empirically tested by means of large-scale quantitative studies, e.g., structural equation modelling.

A crucial question for companies in the future will be how many SCs are suitable for effectively dealing with customer requirements at a competitive degree of SCD ('what is the ideal number of differentiated SCs for a company?'). This question is, however, currently barely answerable, since there is no common understanding of how the number of different SCs in a company or business unit may be counted. This indicates the importance of starting this discussion.

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