

A Work Project, presented as part of the requirements for the Award of a Masters
Degree in Management from the NOVA – School of Business and Economics.

The Effectiveness of Supply Chain Management on Firms' Performance:

A Comparative Case Study

Conrad Dundalek

Student Number 686

A project carried out under the supervision of:

Pietro de Giovanni

06/01/2012

The Effectiveness of Supply Chain Management on Firms' Performance: A Comparative Case Study

Abstract

The purpose of the paper is to investigate the effectiveness of supply chain management (SCM) practices to increase a company's performance based on a cross-border and cross-sector analysis. The paper follows a comparative case study approach which was achieved by interviewing supply chain management experts of three companies operating in different industries and positions in a supply chain. Practices that were mutually applied by the firms and their contribution to achieve quality, economic, cost, and time advantages were analyzed. The paper revealed practices, which contribute the most to increase specific performance areas.

Keywords: Supply chain management, effective practices, multiple case study, cross-country

Legend of Figures

Figure 1: Extent of Investment	17
Figure 2: Impact on Level of Service	19
Figure 3: Impact on Sales Growth.....	20
Figure 4: Impact on Cost Savings	21
Figure 5: Impact on Inventory Reduction.....	22
Figure 6: Impact on Order Lead Time.....	24
Figure 7: Summary of Practices' Impact on Performance	25

Introduction

Today's business environment is characterized by geographical disparity of suppliers, manufacturing facilities, and sales markets. Companies are pressured to adapt to changes in the environment more quickly in order to satisfy increasingly more demanding customers in a prompt fashion. In order to effectively satisfy growing customer expectations, companies are required to collaborate with its suppliers. Suppliers, in turn, depend on the orders of companies located downstream the supply chain, which is why both parties are interested in a well-functioning SCM. To be able to effectively respond to customer needs at relatively low costs, SCM becomes ever more important to compete at a local and global level.

Core of this thesis is to investigate the effectiveness of SCM practices as to increase a company's performance. Previous empirical research investigating SCM practices support the fact that SCM is a key element and effective tool for such an increase (Kannan and Tan 2005; Ou et al. 2010).

Many studies have been performed in order to indentify and validate SCM practices and to measure their impact on performance. In their study on 474 US manufacturers, Tracey et al. (2005) showed that SCM capabilities such as supplier communications and inventory control are essential factors in financial and market performance. Koh et al. (2007) investigated 72 manufacturing small-medium-enterprises (SMEs) in Turkey and revealed that outsourcing and multi-suppliers as well as strategic collaboration and lean practices have a significant impact on operational performance. A study carried out by Bayraktar et al. (2009) examined 203 manufacturing SMEs in Turkey and showed that SCM and information systems (IS) practices significantly improve operational performance. By investigating 196 US manufacturers, Li et al. (2006) presented that

SCM methods lead to improved competitiveness and superior firm performance. Similar, Tan et al. (2002) and Tan (2002) examined 101 and 411 US manufacturers from different industries and revealed that SCM practices positively impact performance. Vickery et al. (2003) highlighted by investigating 57 first-tier US automotive suppliers that supply chain integration (supplier and customer relations) positively impact firms' performance via improved customer service.

However, empirical research investigating the effectiveness of SCM practices lacks contributions comparing firms' performance before and after their implementation. This paper intends to fill this gap by measuring the *realized* impact of SCM practices on performance. It aims at answering the question which SCM practices have a real and positive impact on a company's performance. As a result, this paper will provide insights into which practices are implemented in companies and to what extent they contribute to a company's performance – regardless of the size and industry sector of a company or its position in a supply chain.

To answer this question, a comparative case study approach was adopted. Based on three interviews with SCM experts out of the business community, the impact of mutually implemented SCM practices on the companies' performance was investigated by comparing the impact on key performance indicators (KPIs).

Initially, the paper gives an overview of the concept of SCM. It follows with an explanation of SCM methods under investigation. Section 2 describes the explored KPIs. Subsequently, explanations of the methodology follow in section 3. Section 4 consists of the empirical part in which the supply chains of the three case companies are

described and empirical findings are presented. The paper concludes with a discussion of results.

Supply Chain Management and its Practices

A supply chain consists of all parties involved in processing a customer order. This includes not only functions internal to the company itself, but also external partners like suppliers, logistic providers, retailers, and the customers (Chopra and Meindl 2010: 20). The concept of SCM is relatively new and there is no consensus regarding a uniform definition in the literature (Skjøtt-Larsen et al. 2007: 20). However, according to a widely cited definition,

“SCM is the integration of all activities associated with the flow and transformation of goods from raw materials through to end user, as well as information flows, through improved supply chain relationships, to achieve a sustainable competitive advantage.”
(Handfield and Nichols 1999: 2).

This highlights the integrative character of SCM. Moreover, achieving a competitive advantage in a supply chain context becomes evident in the improvement of the variables quality, costs, time, and flexibility (Ho et al. 2002; Tracey et al. 1999). In other words, the objective of an effective SCM is to generate an outstanding customer benefit at the lowest possible costs.

SCM practices have been defined as a group of activities in order to support an effective management of a company's supply chain (Li et al. 2005). The literature review revealed various practices, which could play an important role for improving a company's performance. However, it should be noted that there is no clear identification of SCM dimensions. Li et al. (2005) and Li et al. (2006) identified six dimensions of

SCM practices, which include strategic supplier partnership, customer relationship, level and quality of information sharing, and postponement. Similarly, Vickery et al. (2003) focus on integrative information technologies and practices that strengthen the linkage between companies within the supply chain. Tan et al. (2002) and Tan (2002) identified 24 SCM practices and formed six dimensions: supply chain integration and characteristics, information sharing, customer service management, geographical proximity, and just-in-time (JIT) capability. Koh et al. (2007) and Bayraktar et al. (2009) identified 12 SCM practices: JIT supply, many suppliers, holding safety stock, subcontracting, few suppliers, close partnership with suppliers, strategic planning, outsourcing, third party logistics, close partnership with customers, e-procurement, and supply benchmarking. Halley and Beaulicu (2010) investigated SCM practices of Canadian manufacturers by using four constructs (interlinking, consultation, sharing, detachment) and showed that practices are used more intensively with clients than with suppliers. Robb et al. (2008) considered four dimensions of SCM practices for investigating Chinese furniture manufacturers: customer and supplier relationships, e-commerce, and enterprise software. Ulusoy (2003) investigated four sectors of the manufacturing industry in Turkey using four dimensions: logistics, supplier relations, customer relations, and production.

It becomes evident that practices can be classified into numerous areas. Many practices were directed to collaboration or partnership, supply chain relations, logistics, lean capabilities, evaluation, information sharing, use of external companies, or technology support. However, it should be noted that SCM practices depend on the size of the firm, type of industry, supply chain characteristics, and a company's position within a supply chain. This is the reason why larger companies might have implemented more practices

as their supply chains are usually more complex. Based on the literature, numerous commonly cited practices were identified. In order to compare the practices' impact on performance, the paper will focus only on mutually implemented practices among the investigated firms, which include: *Development cooperation with suppliers, information sharing with suppliers, supplier management, JIT supply, vendor managed inventory (VMI), use of third party logistics provider (3PL), electronic data interchange (EDI), supply chain controlling, and implementation of an enterprise resource planning (ERP) system.*

Development cooperation with suppliers represents collaboration in the area of product development or the integration of supplier know-how into products. High supplier performance may lead to outstanding quality (Ragatz et al. 1997). *Information sharing with suppliers* addresses the scope and quality of shared information with suppliers, i.e. forecasts, production plans, sales numbers, planned promotion or information concerning inventory levels (Moberg et al. 2002). *Supplier management* refers to the monitoring of a suppliers' performance and development efforts as an attempt to improve their performance (Shin et al. 2000). *JIT supply* constitutes a practice in which goods or components are manufactured and delivered by the supplier in the right time and quantity only when required by the customer and, thus, it is used to reduce inventory. Therefore, the consistent conformance of a suppliers' performance is essential (Mistry 2005). Only material, which is necessary to keep production running, is stored on the production site. Hence, production steps and transportation time need to be scheduled accurately. With regard to *VMI*, the supplier is responsible for maintaining an agreed inventory at the customer's site. Its major characteristic is that material is not billed until it is taken out. Thereby, buyers can lower their working capital and demand

uncertainty is mitigated on the suppliers' side (Waller et al. 1999). *3PL* can be defined as a supplier, who performs several functions to provide solutions for logistics problems (Hertz and Alfredsson 2003). Activities can consist of transportation, warehousing, distribution or other value-added services such as picking and packing. *EDI* refers to technology support for the *SCM* via electronic data exchange. The electronic exchange of standardized data in a common format allows seamless communication with supply chain partners (Mukhopadhyay et al. 1995). *Supply chain controlling* is responsible for controlling the supply chain performance. This includes the continuous measurement and monitoring of KPIs for performance evaluation to optimally achieve corporate targets (Werner 2008). *ERP systems* are integrative information systems which link the activities of a company (Schönsleben 2011a). They include various processes, methods and techniques to support effective planning and control of required resources. Typical functional areas are material management, production, finance and accounting, controlling, research and development (R&D), sales and marketing, human resources (HR), or data administration. Specific modules can be combined and integrated into the corporate system according to a company's needs. The leading providers of such software systems are the German company SAP or the U.S. based company Oracle.

Performance Measures in Supply Chain Contexts

An effective supply chain provides excellent service while keeping costs low at the same time. Customers within the manufacturing industry demand an accurate order fulfillment in the required quality, quantity, and time. Companies can improve the order fulfillment, among other factors, by keeping high inventory levels and over-capacities which, in turn, increases costs. However, by trying to keep inventory levels low, companies may fail to fulfill customer orders in an accurate manner. Both, a large

surplus as well as a lack of resources, is inefficient and increases waste of capital and time. An effective supply chain manages to efficiently use economical resources while providing an ideal service to customers.

Indicators measuring the positive effects of SCM practices on performance can be divided into four categories: *quality, economic, cost, and time advantages*. It has been shown that quality, cost, and time advantages generally occur regardless of the supply chain's industry sector (Leitl 2005). In general, it is expected that a well-functioning supply chain helps to increase sales due to higher customer service and a shorter response time, reduce costs, and lower the invested capital (Grosspietsch and Küpper 2004; Stock and Lambert 2001: 35).

Measuring a firms' performance based on simple indicators is rather complex. Literature reveals several common performance indicators for practices (Chae 2009; Green Jr. et al. 2008; Grosspietsch and Küpper 2004; Gunasekaran et al. 2001; Koh et al. 2007; Melnyk et al. 2004; Robb et al. 2008; Tan et al. 2002; Tan et al. 1999; Vickery et al. 2003). In order to facilitate data collection during the survey, this study focuses on five performance indicators:

1. Increase in level of service,
2. Sales growth,
3. Cost savings,
4. Decrease in inventory levels, and
5. Decrease in order lead time.

Level of service refers to as the quality standard. Excellent service means to optimally meet customer needs. To measure the level of service in the manufacturing industry,

this study concentrates on the commonly used measure “On Time In Full” (OTIF). This ratio indicates the proportion of correctly filled order items (based on quantity, quality and time) as a percentage of all order items (Grosspietsch and Küpper 2004; Thonemann et al. 2007). Not only is this indicator frequently measured by companies, but it also indirectly covers all important aspects of service such as defects, complaints, and delivery dependability.

Sales growth refers to the economic performance. An improvement of this measure generally results from an improvement in performance in the areas quality, cost or time.

Due to the lack of cost comparability, costs were not distinguished by nature. In broad terms, however, *cost savings* include all costs associated with operating the supply chain such as material and production costs, costs for storage and transportation, R&D costs, or administrative costs.

Inventory levels include stored goods such as items, which are used for production (raw materials) or items for customers (finished goods) (Schönsleben 2011b). High inventory levels help to satisfy the customer tolerance time. However, inventories also entail disadvantages such as the requirement of large capital investments as they represent unused assets and occupy otherwise productive space. Maintaining low inventory levels suggest that inventory is replaced more often during a time period. A high inventory turnover implies that inventory is well managed and is, therefore, an indicator of the efficient use of resources.

The *order lead time* is the time required to receive, fulfill, and deliver a customer order, from the moment a customer authorizes a sales order until the receipt of the products (Gunasekaran et al. 2001; Schönsleben 2011b: 9). It represents the ability to deliver on

time and respond to customer demands quickly. A reduction in order lead time increases the responsiveness of the supply chain (Gunasekaran et al. 2001).

Methodology

The research follows a comparative case study approach to examine the effectiveness of SCM practices to increase a company's performance. Given the exploratory character of the thesis, the case study approach was considered to be an appropriate methodology, since a case study methodology provides a detailed investigation that would not be possible in a broad study (Sridharan et al. 2005; Yin 2003).

The companies, which were selected for the study, represent participants from different industries and positions within a supply chain. The companies were located in Germany and France and included "fast moving consumer goods" (FMCG) manufacturers (case companies A and B), and a supplier of the automotive industry (case company C). FMCG are products which cover daily needs and are sold relatively fast. These include items sold in retail outlets such as cosmetics, toiletries, household and food products. Company C manufactures modules and chassis structures for automobile manufacturers.

Semi-structured interviews were conducted with supply chain managers in person or via telephone. This interview design guaranteed both, the comparability of results and the inclusion of all relevant aspects which have previously been identified. Besides, it provides sufficient flexibility for data collection and discussions to explore critical aspects. Moreover, the survey allowed collecting both, qualitative and quantitative information. Open questions were used to receive information for describing the companies and the supply chain they are operating in. After the interview, a follow-up online questionnaire, regarding mutually implemented practices among the firms, was

send to the managers. Based on a seven-point-Likert scale (1 = low, 7 = high) they were first asked to indicate the extent of investment that is the invested capital, time and commitment in a respective SCM practice. In a second step they were asked to rate the realized impact on performance. The interviews were recorded on tape. In addition to the primary data, the case study was supported by secondary data composed of published information and corporate websites. All data collected from the companies were treated confidential. An abstract of the interview guide (Appendix 1) as well as a screenshot of the online questionnaire (Appendix 2) can be found in the appendix.

Empirical Observations

The following section contains information about the case companies' supply chains and an analysis of the realized impact of practices, which are mutually implemented among the firms.

Case Company A

Case company A represents a leading FMCG manufacturer. The interview was conducted with the supply chain manager of a French business unit. The company is listed among the 500 largest companies in the world (Fortune Global 500) with sales of several billion Euros. Especially the business unit under investigation holds leading positions in important markets worldwide. Moreover, it has been honored for its excellent SCM efforts and the supply chain performance achieved high rankings in benchmarking studies.

In regard to the supply side, the company tries to limit the number of suppliers. It focuses generally on huge chemical suppliers, which have implemented EDI and are located in Europe. However, it should be noted that there is a lack of alternative

chemical companies in the region. Development cooperation exists mostly with manufacturers of packaging material. In order to avoid inventory in plants, the company focuses on JIT supply and VMI. Suppliers participating in VMI account for 60% of expenses in France. Suppliers are connected to the corporate ERP system to prepare the corresponding supply according to planned productions. This allows extensive monitoring of suppliers as well as sharing results within the company. The ERP system includes all important modules from SAP except for warehouse management, since this is offered by a logistics provider. In addition to 28 production plants over the world for the business unit, which also help in terms of bottleneck capacity, company A keeps one factory accounting for approximately 70% of sold products within the country. The company holds two warehouses in order to store the assortment, which are operated by an external logistics provider and shared with another competitor. The logistics provider is responsible for all warehousing services such as storage, picking, packing or transportation. 50-60 orders are received every day, which are then transported in fully loaded trucks shared with competitors to the retailers' warehouses. This allows the company to respond to market demands at minimum costs, which was mentioned as a crucial aspect. Highlighting the focus to minimize suppliers, 95% of the transportation is done by six to nine carriers. The company's customers include major retailers in the country of which the top seven control 98% of the turnover. Most of the customer requests are night deliveries so that the products can be shipped into the stores early in the morning. Thus, the order fulfillment sequence is relatively short. 95% of customer orders are covered in terms of EDI. The company controls the performance of its supply chain such as the service level of suppliers or its own service level frequently, and is continuously evaluated by its customers as well.

Case Company B

Case company B represents a leading FMCG manufacturer operating globally. The interview was conducted with the supply chain manager responsible for the region Germany, Austria, and Switzerland. The company is listed among the 500 largest companies in the world (Fortune Global 500) with sales of several billion Euros. Its supply chain performance has been classified high in several rankings, which underlines the quality of its SCM efforts. SCM is an area of strategic importance for the company, which is reflected by the fact that it holds a representative on the board of directors. Moreover, it has its own supply chain company that is responsible for process optimization along the supply chain and reducing the overall supply chain costs while maintaining an ideal service level.

The supply chain of case company B is similar to the one of case company A, as it is also a manufacturer of packaged goods supplying the retail industry. In regard to the supply side, the company extensively monitors its suppliers via supplier-scorecards. These help the company to measure the suppliers' performance and identify potential for improvement as well as key suppliers. In case a supplier has room for improvement, it provides know-how, as it believes both parties will profit. Joint business plans are developed with key suppliers such as aroma producers or manufacturers of packaging material out of which many innovations have resulted. In terms of the procurement side the company makes use of VMI, consignment stock, or JIT supply – whatever is beneficial and suitable depending on raw material characteristics and locations of suppliers. Suppliers are integrated into the company via EDI interfaces, supplier portals or full integration into the corporate ERP system. Suppliers are provided with all

information which can be advantageous for their planning such as weekly sales plans or full integration in case of JIT suppliers.

In general, production facilities are specialized on certain categories or local products. Since retailers order more frequently and in smaller quantities, the company focuses on flexibility and pull-production. Subcontractors are used for some categories and are part of the supply chain strategy to counter unexpected problems. The company stores its assortment in company owned warehouses. Nonetheless, it also makes use of warehouses that are operated by an external logistics provider and shared with another competitor. The logistics provider is responsible for all warehousing services as for example storage, picking, packing, or transportation in form of shared trucks. JIT delivery, consignment stock or VMI is likewise used on the customer side. The company itself manages transportation planning from suppliers to production facilities or from the production sites to warehouses. However, it does not own trucks. Attempting to pool deliveries, retailers have 70-80% of the volumes delivered to central warehouses; the remaining is delivered to outlets directly. Similar to company A, retailers share more information with suppliers than the other way around. They are inclined to do so in order to contribute to more cost-efficient processes of suppliers in the hope to receive price advantages. Information is shared with customers through EDI. The company continuously measures its supply chain performance based on various KPIs. This process is supported by a corporate ERP system, which contains numerous modules including warehouse management. Especially the unified European SAP platform supports the linkage of all locations in Europe and creates transparency about all facilities.

Case Company C

Case company C represents a supplier of the automotive industry with subsidiaries around the world. More than 3,000 employees generated sales of around 500 million Euros. The interview was conducted with a supply chain management expert in Germany.

Similar to case companies A and B, company C attempts to limit the number of its suppliers. It aims to form strategic partnerships with suppliers to link them to the company and to ensure a high quality standard. In order to synchronize production plans and facilitate better planning for the suppliers, information is shared and most of the suppliers are connected via EDI to the corporate information system. To ensure that suppliers meet quality requirements, they are continuously monitored. In general, company C is being delivered JIT by its suppliers. However, since this depends on the location of the suppliers, it is not always feasible. As a result, it also applies VMI. The same holds true for the company itself, as it follows the trend within the automotive industry. Depending on the specifications of customer orders, it delivers either JIT or to a logistics center in case of huge original equipment manufacturers (OEMs), where the company is required to hold inventory levels for three to five days. Occasionally, it delivers just-in-sequence (JIS) where goods need to be stored on the rack and truck in a specific order. Information is shared via EDI with customers in both directions to coordinate all production activities. Therefore, the customer has information about inventory levels or provides information about planned productions. The company continuously measures its performance. Correspondingly, customers require certain KPIs and many have implemented supplier portals, where suppliers' KPIs are displayed. The corporate ERP system includes all major modules. That is why, for instance,

production planning as well as logistics, distribution/sales, and procurement is done via ERP. 3PLs are responsible for the planning of vehicle routing as well as for the transport itself. In 2010, company C initiated a project similar to the Toyota production system. Now, experts in locations all around the world try to further optimize various processes like production and logistics processes or processes with supply chain partners and seek and evaluate opportunities to reduce inventory and lead times.

Analysis of Implemented SCM Practices

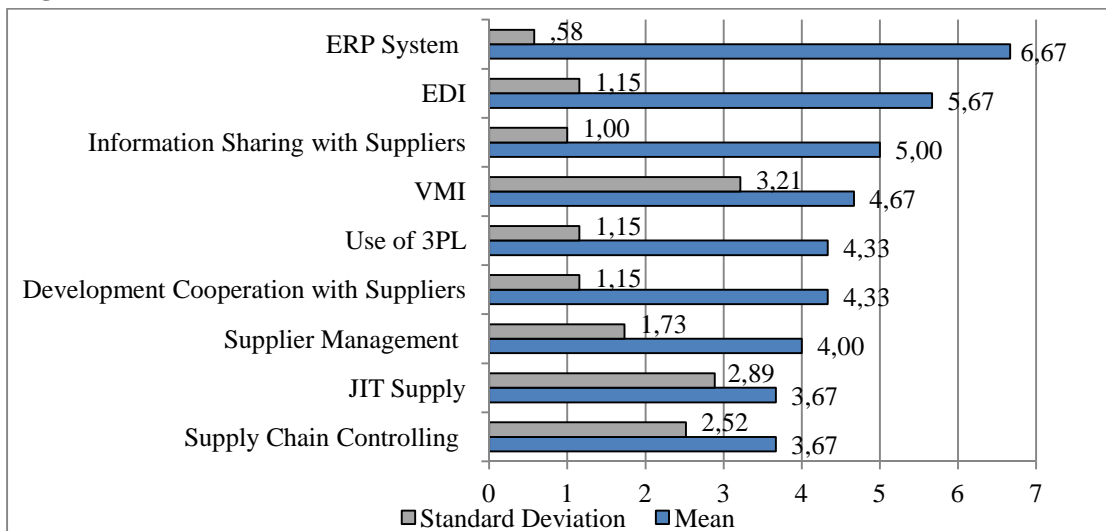
This section contains a presentation of the empirical findings. The analysis is based on quantitative information, which was gained from the online questionnaire. For the purpose of this study, the realized impact of SCM practices on performance indicators was measured according to the perception of the interviewed SCM experts, as it was difficult to provide exact numbers regarding the contribution of a specific practice. The analysis focuses on the nine mutually implemented practices among the case companies. Previous research on SCM benefits uses the mean and standard deviation to explain results (Arlbjørn et al. 2006; Meehan and Muir 2008). Moreover, it uses a standard deviation of up to 1.46 based on a five-point-Likert scale to describe its results. Based on the similar research focus of this paper, the standard deviation and mean are likewise considered as important elements. Moreover, due to initially relatively high standard deviations, this thesis has limited results to those below values of 1.54 in order to maintain results significant. In comparison with the previously mentioned similar research, this figure is substantially lower and thus more predictive.

Extent of Investment

Results indicate that the two bigger companies are relatively more engaged in the implementation of SCM practices. They invest more time, capital and commitment in

SCM practices. This is based on the fact that their supply chains are more complex and that SCM is an essential part of their strategy. In all practices, except for the *JIT supply*, both companies were more invested in SCM practices compared to case company C. The mean degree of investment for the nine SCM practices ranged from 3.67 to 6.67 with a median of 4.33 (Figure 1). The four highest ranked practices are the *ERP system* (6.67), *EDI* (5.67), *information sharing with suppliers* (5.00), and *VMI* (4.67). A high standard deviation or low rating, however, does not imply that the other practices are less important for the companies. As previously mentioned, practices depend on several aspects such as product characteristics, location of suppliers, or requirements of the customers. They are not applied in every situation and for all products. Therefore, *VMI* is not extensively used by case company C. The same applies to *JIT supply*, which is only used profoundly by case company A.

Figure 1: Extent of Investment



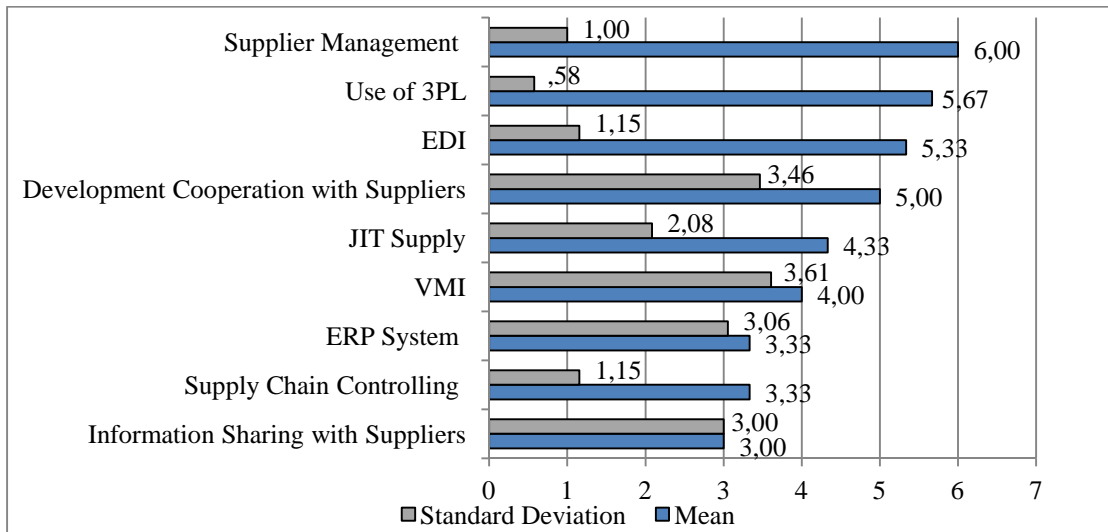
Level of Service

With regard to level of service, practices achieved, in average, the highest performance improvement. The mean responses regarding the impact of the practices on service

improvement ranged from 3.00 to 6.00 with a median of 4.33 (Figure 2). Results reveal a relatively consistent rating concerning the impact of four practices. *Supplier management* (6.00), *use of 3PL* (5.67), and *EDI* (5.33) contribute the most to increase customer service. Further, *supply chain controlling* (3.33) is ranked to have a moderate impact on service level. The relatively low standard deviations of the mentioned practices support generalization of the results. *Supplier management* ensures the constant conformance of suppliers to performance specifications. Since a high supplier performance leads to superior quality, actions are taken if performances are poor. *3PLs* are responsible for cost efficient storage and reliable, timely transportation. Their contribution is ranked almost consistently crucial among the companies. *EDI* supports the integration of suppliers and customers and provides faster, timely information. *Supply chain controlling* monitors and evaluates the supply chain's performance to achieve corporate objectives.

Due to the relatively high standard deviation, results regarding the impact of other practices do not allow generalization. As for example, the two big companies rank the impact of *development cooperation with suppliers* high, only company C lists a low impact. *JIT supply* is only ranked low by case company B. Among the other two companies, it achieves a relatively high impact. Differing ratings for *VMI*, the *ERP system* and *information sharing with suppliers* also make generalization difficult.

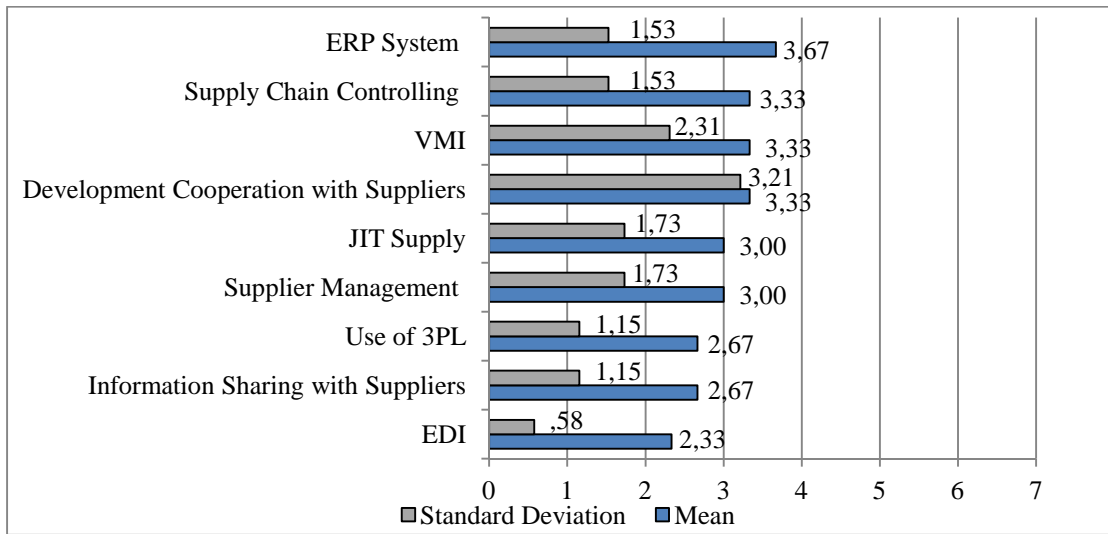
Figure 2: Impact on Level of Service



Sales Growth

The results regarding the impact of practices on sales growth are presented in figure 3. The mean responses ranged from 2.33 to 3.67 with a median of 3.00. The practices with a relatively low standard deviation and which, therefore, allow generalization are the *ERP system* (3.67), *supply chain controlling* (3.33), *use of 3PL* (2.67), *information sharing with supplier* (2.67), and *EDI* (2.33). It is not possible to generalize the results regarding the other practices, as the ratings differ. It can be observed that the direct impact of the practices on sales growth is relatively low. The *ERP system* and *supply chain controlling* are, however, ranked to have the highest moderate impact on sales growth. These practices foster the gathering and analysis of information, which, in turn, support the achievement of corporate goals. The low impact can be explained, since it is difficult to measure a direct relation between SCM practices and sales. Nevertheless, it is expected that sales increase due to higher levels of service and shorter response time.

Figure 3: Impact on Sales Growth



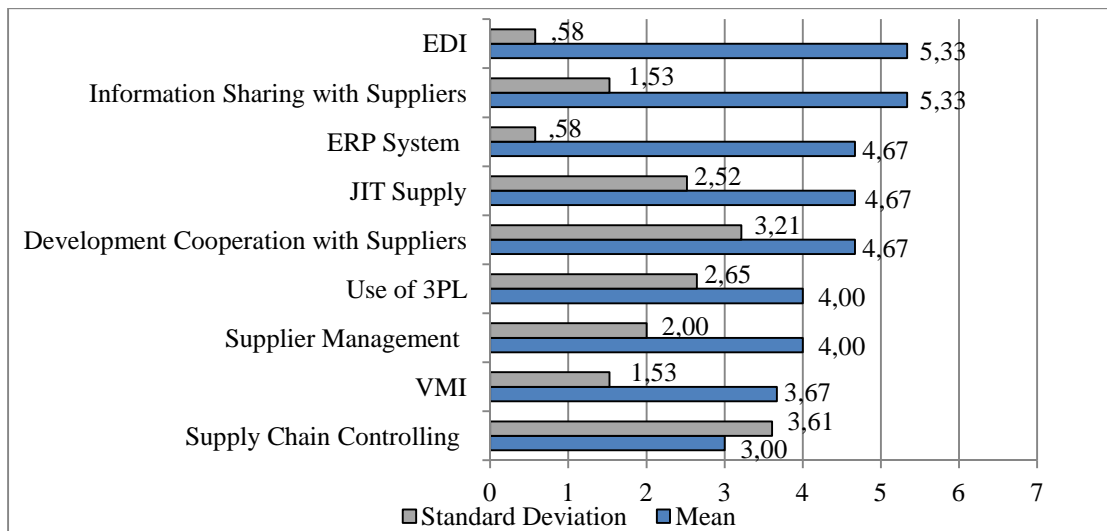
Cost Savings

The average impact, which the practices have on cost savings, is similar to the one they have on service level improvement (Figure 4). The mean responses regarding the contribution to cost savings ranged from 3.00 to 5.33 with a median of 4.67. Results are found relatively consistent for *EDI* (5.33), *information sharing with suppliers* (5.33), *ERP system* (4.67), and *VMI* (3.67). It is not surprising that practices related to *information technology and sharing* have the highest impact on cost reductions, since information is critical to maintain efficient operations along the supply chain. Thus, they are ranked almost consistently by all three companies. The *ERP system* helps to support the efficient planning of resources. *VMI* lowers expenses of the buyers as the suppliers perform inventory management. Further, it allows that only a few units along the supply chain perform demand forecasts. Thereby, inaccurate demand forecasts are diminished which support a precise planning of resources.

With regard to the other practices, the results do not support generalization due to the relatively high standard deviation. Even though *JIT supply*, among other factors,

reduces the costs for handling and storage, the companies rate differently. Although the two bigger companies rank the impact relatively high, it is ranked low by the small company. The same applies to *development cooperation with suppliers*, which both huge companies rank crucial for saving costs. Further, there was no consistency in ratings regarding *supplier management* as well as for the *use of 3PLs*. Only case company A ranks the impact of *3PLs* high. As previously explained, it plays a significant role in saving costs and being competitive in its case. Similar, *supply chain controlling* has only a high impact at case company A.

Figure 4: Impact on Cost Savings



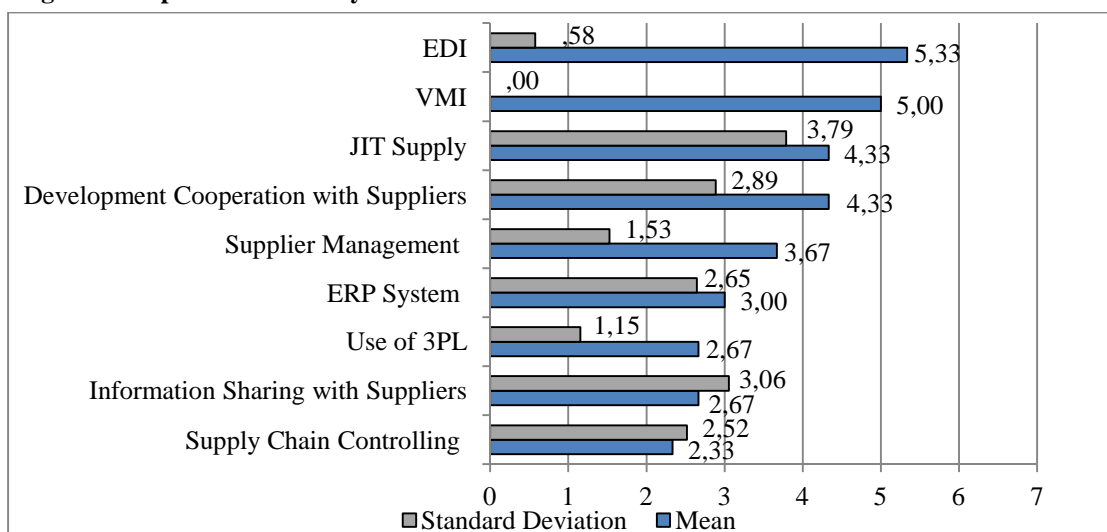
Inventory Levels

Figure 5 presents the practices' impact on inventory reduction. The impact of practices ranged from 2.33 to 5.33 with a median of 3.67. Results were found almost consistent for *EDI*, *VMI*, *supplier management*, and *3PL*. They reveal that *EDI* (5.33) and *VMI* (5.00) contribute the most to higher inventory turnovers. As information replaces inventory along the supply chain, it is not surprising that *EDI* has the highest impact as it fosters the fast exchange of information. The low standard deviation, again, supports

the crucial contribution as it is ranked almost consistently. *VMI* supports an accurate forecast of demand. As a result, shortages are minimized and inventory turnovers are increased since less safety stock needs to be kept. The standard deviation of zero supports the importance of the practice. Moreover, results are found relatively consistent for *supplier management* (3.67) and *use of 3PL* (2.67). In order to maintain low inventory levels, a company must rely on its suppliers' performance. The *supplier management*, therefore, assures the compliance with performance specifications.

Regarding other practices, results do not support generalization. Even though two companies respectively ranked the impact of *JIT supply* and *development cooperation with suppliers* relatively high, one company always ranks the contribution of the respective practices low. Further, results do not support generalization concerning the impact of *information sharing with suppliers* and *supply chain controlling* since the standard deviation is higher than the mean and, therefore, imply high differing ratings. The impact of the *ERP system* was found to have a middle impact in two companies. It only does not contribute to inventory reductions at case company B.

Figure 5: Impact on Inventory Reduction

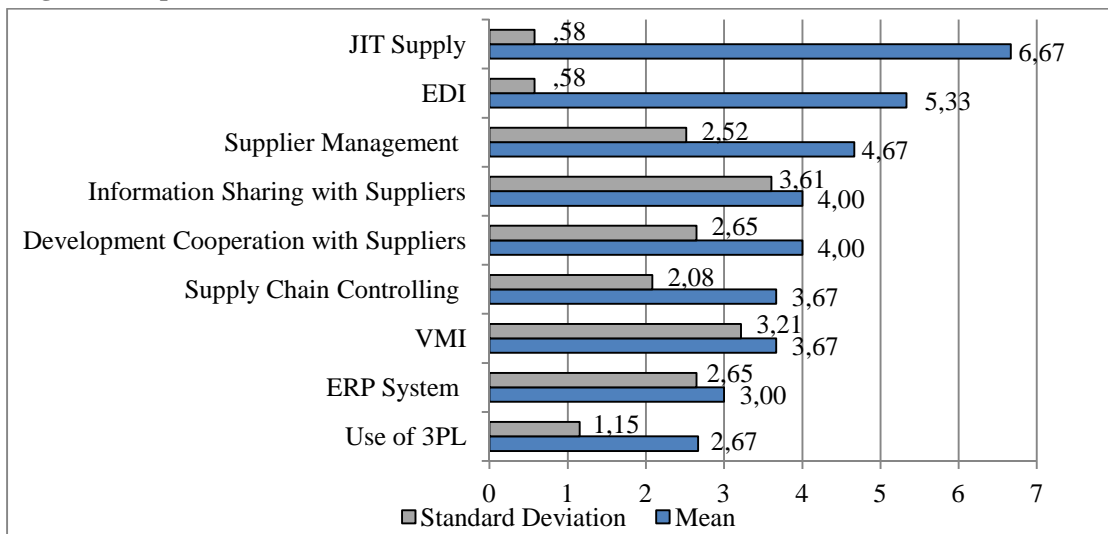


Order Lead Time

Results of each practices' contribution to increase the responsiveness of the supply chain are shown in figure 6. The mean impact of practices ranged from 2.67 to 6.67 with a median of 4.00. It can be observed that most ratings regarding the practices' impact are not consistent. Therefore, only few generalizations are possible. The highest consistently ranked practices are *JIT supply* (6.67), *EDI* (5.33), and *use of 3PL* (2.67). The low standard deviation of *JIT supply* and *EDI* supports the crucial contribution of the two practices. An interesting observation is that *JIT supply* has the highest impact within a single performance area. For a successful *JIT supply*, operational processes along the supply chain need to be aligned. Moreover, a consistent performance of suppliers is crucial. *JIT* capabilities enable both, the supplier and buyer, to reduce waste and, therefore, contribute to efficient processes. *EDI* supports this process by providing timely and accurate information. As a result, responsiveness to market demands can be increased.

Results regarding the other practices do not allow generalization due to the relatively high standard deviation. Hence, even though, two companies ranked the impact of *supplier management* (4.67), *information sharing with suppliers* (4.00), *development cooperation with suppliers* (4.00) and *VMI* (3.67) as relatively high, one company always records a low impact. Differing ratings are also reported regarding *supply chain controlling* and the *ERP system*.

Figure 6: Impact on Order Lead Time



Overview of Realized Impact

Figure 7 summarizes the impact of almost consistently ranked practices in the respective performance areas. The results reveal that the highest impact in a single performance area is achieved by *JIT supply* (6.67) to decrease order lead time, followed by *supplier management* (6.00) to increase service level, *EDI* (5.33) to reduce costs and inventory, and the *ERP system* (3.67) which contributes the most to increase sales. With disregard to sales, *EDI* achieves a high impact in every performance area.

With regard to the respective performance areas, the investigation provides evidence that practices, which contribute the most to increase level of service, are *supplier management* (6.00), *use of 3PL* (5.67), and *EDI* (5.33). The impact of practices on sales growth is only moderate. However, among the practices, the *ERP system* (3.67), *supply chain controlling* (3.33), *use of 3PL* (2.67) and *information sharing with suppliers* (2.67) contributed the most. The highest improvement on cost savings is achieved by *EDI* (5.33), *information sharing with suppliers* (5.33), and the *ERP system* (4.67). Inventory levels are reduced the most by *EDI* (5.33), *VMI* (5.00), and *supplier*

management (3.67). Moreover, the responsiveness can be improved the most through a reduction in order lead time by *JIT supply* (6.67) and *EDI* (5.33).

Figure 7: Summary of Practices' Impact on Performance

Practices	Increase in Service Level	Sales Growth	Cost Savings	Decrease in Inventory Levels	Decrease in Order Lead Time
Development Cooperation with Suppliers					
Information Sharing with Suppliers		2.67	5.33		
Supplier Management	6.00			3.67	
JIT Supply					6.67
VMI			3.67	5.00	
Use of 3PL	5.67	2.67		2.67	2.67
EDI	5.33	2.33	5.33	5.33	5.33
Supply Chain Controlling	3.33	3.33			
ERP System		3.67	4.67		

Only those practices' impact is listed, whose standard deviation is lower than 1.54

Conclusion

This paper sought to evaluate the effectiveness of SCM practices to increase a company's performance. The investigation was based on a comparative case study of three companies. Mutually implemented SCM practices and their impact to increase the companies' performance were analyzed. The results provide evidence that practices contribute to the increase of the supply chain's responsiveness by reducing the order lead time. Additionally, they foster the increase of the level of service, cost savings and the efficient use of resources. Moreover, practices regarding information technology and sharing, logistics activities, and supplier relations play an important role in increasing performance.

The research revealed that companies try to shift their supply chain towards a pull-supply-chain. Customers are keen to improve a supplier's performance and share relevant information. Even though companies may compete on the same market, they frequently work together in the supply chain to achieve cost advantages. Companies

realize that collaboration has several advantages and, when working together, they can gain a more competitive business. It is important to focus on selected partners with whom a company wants to maintain a long-term relationship. Huge companies have already implemented up-to-date technology to support faster response and efficiency. In order to improve planning, transparency and communication among the partners will remain to be critical in the future.

This paper contributes to a better understanding of working SCM practices. The research provides insights into the current status of applied practices and the environment of implementation in the FMCG and automotive industry. It can assist companies in implementing SCM practices. Especially for SMEs, where state of the art support systems are often times still lacking and SCM is not yet widely deployed, this paper provides guidance for supply chain managers, who plan to apply SCM practices in a structured and empirically founded way to improve specific performance areas. The reader must decide, if these results are applicable to other cases. Since the case study approach captures a given situation, companies can evaluate whether practices are applicable in their corporate environment.

Limitations are given due to the focus solely on the FMCG and automotive industry. Hence, future papers may extend the focus and include companies from other industries. Moreover, more performance measures can be included in future studies to provide a more detailed investigation of practices' impact on performance.

Bibliography

- Arbjørn, Jan Stentoft, Henning De Haas, Rasmus Caspersen, John Johansen, and Jørgen Nørmølle.** 2006. "Improved change readiness through supply chain competency development." *Industrial and Commercial Training* 38 (3): 128-136.
- Bayraktar, Erkan, Mehmet Demirbag, S.C. Lenny Koh, Ekrem Tatoglu, and Halil Zaim.** 2009. "A casual analysis of the impact of information systems and supply chain management practices on operations performance: evidences from manufacturing SMEs in Turkey." *International Journal of Production Economics* 122 (1): 133-149.
- Chae, Bongsug Kevin.** 2009. "Insight from industry Developing key performance indicators for supply chain: an industry perspective." *Supply Chain Management: An International Journal* 14 (6): 422-428.
- Chopra, Sunil, and Peter Meindl.** 2010. *Supply chain management. Strategy, planning, and operation.* Boston: Pearson.
- Green Jr., Kenneth W., Dwayne Whitten, and R. Anthony Inman.** 2008. "The impact of logistics performance on organizational performance in a supply chain context." *Supply Chain Management: An International Journal* 13 (4): 317-327.
- Grosspietsch, Jochen, and Jörn Küpper.** 2004. "Supply chain champs." *Mckinsey Quarterly* 1 (March): 18-20.
- Gunasekaran, A., C. Patel, and E. Tirtiroglu.** 2001. "Performance measures and metrics in a supply chain environment." *International Journal of Operations & Production Management* 21 (1/2): 71-87.
- Halley, Alain, and Martin Beaulicu.** 2010. "A multidimensional analysis of supply chain integration in Canadian manufacturing." *Canadian Journal of Administrative Sciences* 27 (2): 174-187.
- Handfield, Robert B., and Ernest L. Nichols.** 1999. *Introduction to supply chain management.* Upper Saddle River: Prentice Hall.
- Hertz, Susanne, and Monica Alfredsson.** 2003. "Strategic development of third party logistics providers." *Industrial Marketing Management* 32 (2) (February): 139-149.
- Ho, Danny C.K., K.F. Au, and Edward Newton.** 2002. "Empirical research on supply chain management: a critical review and recommendations." *International Journal of Production Research* 40 (17): 4415-4430.

- Kannan, Vijay R., and Keah Choon Tan.** 2005. "Just in time, total quality management, and supply chain management: understanding their linkages and impact on business performance." *Omega* 33: 153-162.
- Koh, S.C. Lenny, Mehmet Demirbag, Erkan Bayraktar, Ekrem Tatoglu, and Selim Zaim.** 2007. "The impact of supply chain management practices on performance of SMEs." *Industrial Management & Data Systems* 107 (1): 103-124.
- Leitl, Michael.** 2005. "Was ist ... Supply-Chain-Management?" *Harvard Business Manager* 27 (9): 37.
- Li, Suhong, B Raguathan, T Raguathan, and S Subbarao.** 2006. "The impact of supply chain management practices on competitive advantage and organizational performance." *Omega* 34 (2) (April): 107-124.
- Li, Suhong, S. Subba Rao, T. S. Ragu-Nathan, and Bhanu Ragu-Nathan.** 2005. "Development and validation of a measurement instrument for studying supply chain management practices." *Journal of Operations Management* 23: 618-641.
- Meehan, Joanne, and Lindsey Muir.** 2008. "SCM in Merseyside SMEs: benefits and barriers." *The TQM Journal* 20 (3): 223-232.
- Melnyk, Steven A., Douglas M. Stewart, and Morgan Swink.** 2004. "Metrics and performance measurement in operations management: dealing with the metrics maze." *Journal of Operations Management* 22 (3) (June): 209-217.
- Mistry, Jamshed J.** 2005. "Origins of profitability through JIT processes in the supply chain." *Industrial Management & Data Systems* 105 (6): 752-768.
- Moberg, Christopher R., Bob D. Cutler, Andrew Gross, and Thomas W. Speh.** 2002. "Identifying antecedents of information exchange within supply chains." *International Journal of Physical Distribution & Logistics Management* 32 (9): 755-770.
- Mukhopadhyay, Tridas, Kekre Sunder, and Kalathur Suresh.** 1995. "Business value of information technology: a study of electronic data interchange." *MIS Quarterly* 19 (2): 137-156.
- Ou, Chin S., Fang C. Liu, Yu C. Hung, and David C. Yen.** 2010. "A structural model of supply chain management on firm performance." *International Journal of Operations & Production Management* 30 (5): 526-545.
- Ragatz, Gary L., Robert B. Handfield, and Thomas V. Scannell.** 1997. "Success factors for integrating suppliers into new product development." *Journal of Product Innovation Management* 14 (3): 190-202.

- Robb, David J., Bin Xie, and Tiru Arthanari.** 2008. "Supply chain and operations practice and performance in Chinese furniture manufacturing." *International Journal of Production Economics* 112 (2): 683-699.
- Schönsleben, Paul.** 2011a. ERP- und SCM-Software. In *Integrales Logistikmanagement. Operations und Supply Chain Management innerhalb des Unternehmens und unternehmensübergreifend*, 435-462. 6th ed. Berlin: Springer.
- Schönsleben, Paul.** 2011b. "Logistik-, Operations und Supply Chain Management." In *Integrales Logistikmanagement: Operations und Supply Chain Management innerhalb des Unternehmens und unternehmensübergreifend*, 3-68. 6th ed. Berlin Heidelberg: Springer.
- Shin, Hojung, David A. Collier, and Darryl D. Wilson.** 2000. "Supply management orientation and supplier/buyer performance." *Journal of Operations Management* 18 (3): 317-333.
- Skjøtt-Larsen, Tage, Philip B. Schary, Juliana H. Mikkola, and Herbert Kotzab.** 2007. *Managing the global supply chain*. 3rd ed. Copenhagen: Business School Press.
- Sridharan, Uma V., Royce W. Caines, and Cheryl C. Patterson.** 2005. "Case study Implementation of supply chain management and its impact on the value of firms." *Supply Chain Management: An International Journal* 10 (4): 313- 318.
- Stock, James R., and Douglas M. Lambert.** 2001. *Strategic Logistics Management*. 4th ed. Boston, Mass.: McGraw-Hill/Irwin.
- Tan, Keah Choon.** 2002. "Supply Chain Management: Practices, Concerns, and Performance Issues." *Journal of Supply Chain Management* 38 (1): 42-53.
- Tan, Keah Choon, Steven B. Lyman, and Joel D. Wisner.** 2002. "Supply chain management : a strategic perspective." *International Journal of Operations & Production Management* 22 (6): 614-631.
- Tan, Keah-Choon, Vijay R. Kannan, Robert B. Handfield, and Soumen Ghosh.** 1999. "Supply chain management: an empirical study of its impact on performance." *International Journal of Operations & Production Management* 19 (10): 1034-1052.
- Thonemann, Ulrich, Klaus Behrenbeck, Jörn Küpper, Andreas Brinkhoff, and Ulf Merschmann.** 2007. *Der Weg zum Supply-Chain-Champion. Harte Fakten zu weichen Themen*. Landsberg am Lech: mi-Fachverlag.
- Tracey, Michael, Jeen-Su Lim, and Mark A. Vonderembse.** 2005. "The impact of supply-chain management capabilities on business performance." *Supply Chain Management: An International Journal* 10 (3): 179-191.

- Tracey, Michael, Mark A. Vonderembse, and Jeen-Su Lim.** 1999. "Manufacturing technology and strategy formulation : keys to enhancing competitiveness and improving performance." *Journal of Operations Management* 17 (4): 411-428.
- Ulusoy, Gündüz.** 2003. "An assessment of supply chain and innovation management practices in the manufacturing industries in Turkey." *International Journal of Production Economics* 86: 251-270.
- Vickery, Shawnee K., Jayanth Jayaram, Cornelia Droge, and Roger Calantone.** 2003. "The effects of an integrative supply chain strategy on customer service and financial performance: an analysis of direct versus indirect relationships." *Journal of Operations Management* 21: 523-539.
- Waller, Matt, M Eric Johnson, and Tom Davis.** 1999. "Vendor-managed inventory in the retail supply chain." *Journal of Business Logistics* 20 (1): 183-203.
- Werner, Hartmut.** 2008. Controlling der Supply Chain. In *Supply Chain Management: Grundlagen, Strategien, Instrumente und Controlling*, 266-403. 3rd ed. Wiesbaden: Gabler.
- Yin, Robert K.** 2003. *Case Study Research: Designs and Methods*. 3rd ed. Sage Publications.

Appendix

Appendix 1: Excerpt from Interview Protocol

Aim of the study is to investigate how effective supply chain management methods are to improve a company's performance. *Aim of the interview* is therefore to find out which SCM practices are used in your company, and how they contribute to increase performance.

In the first part of the interview I would like to ask you some general questions regarding your company's supply chain and its supply chain management. In the second part I would go through the different SC stages and look which SCM methods are applied at your company and common with other companies part of the investigation.

After the interview I would send you an online questionnaire where you can rate the realized impact of mutually implemented SCM practices with other investigated companies on your company's performance.

The results will be treated confidentially.

Permission to record the interview?

General Questions and Supply Chain of the Company

1. What is your function within the company?
2. What are your main responsibilities?
3. How would you describe the supply chain in which your company operates?
 - a. Suppliers
 - b. Production
 - c. Customers and distribution points
4. How is SCM defined in your company?
5. What are your objectives when implementing SCM practices?

Mutually Implemented SCM Practices

In the following, I would now like to check which SCM methods are mutually implemented with other companies part of the investigation. Since the study follows a comparative case study approach, please also explain the applied practices shortly.

1. Development cooperation with suppliers, that is do you collaborate with your suppliers in the area of product development or do you integrate suppliers' know-how into your products?
2. Information sharing with suppliers, that is what is the scope and quality of shared information with your suppliers?
I.e. demand forecasts, production plans, sales numbers, planned promotion, inventory levels
3. Supplier management, that is do you monitor your suppliers' performance and do your perform development efforts to improve their performance?
4. JIT supply, that is are products delivered by suppliers in the right time and quantity only when needed?
5. Vendor managed inventory (VMI), that is are suppliers responsible for maintaining an agreed inventory?
6. Do you make use of a third party logistics provider (3PL)?
I.e. for transportation, storage, picking, packing, customs
7. Do you use Electronic data interchange (EDI) to electronically exchange information with supply chain partners?
8. Supply chain controlling, that is do you frequently measure and monitor relevant KPIs such as service level to evaluate the performance of your supply chain?

9. Enterprise Resource Planning (ERP) system, that is do you have implemented a computer based information system to support effective planning and control of required resources?

I.e. Standard modules like controlling, finance, sales/distribution, HR or production planning & scheduling, capacity planning, warehouse management, transportation planning, quality management, etc.

Appendix 2: Screenshot of the Online Questionnaire

1. Development Cooperation with Suppliers

2. Please indicate the extent of investment, that is the invested capital, time and commitment, in the practice. *

No investment
 Low investment
 -
 -
 Middle investment
 -
 -
 High investment

3. What is the realized impact of the practice to increase performance? *

	No impact	Low impact	-	-	Middle impact	-	-	High impact
Increase in Level of Service *	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sales Growth *	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cost Savings *	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Decrease in Inventory Levels *	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Decrease in Order Lead Time *	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

4. Comments (optional)