Research after types of supply chain integration and the influence of the level of integration on the performance of the supply chain
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MANAGEMENT SUMMARY

In this thesis, a descriptive literature study on supply chain integration is conducted. The objective of this paper is to describe which types of relationships exist between companies in the area of supply chain management. Furthermore, the influence after the level of supply chain integration on the performance level of the supply chain in researched. This results in the following problem statement:

*What types of relationships can be identified in a supply chain and what is the influence of the level of integration on the performance of the supply chain?*

In the second chapter, different relationships in the supply chain are described. According to Lambert et al. (1998) has a supply chain -from the view of the focal company-, primary and supporting members. Based on these two types of members in a supply chain, Lambert et al. (1998) identified four different types supply chain relationships. The findings of Lambert et al. (1998) can be compared with the findings of Mentzer et al. (2001), who identified three levels of supply chain complexity. The second part of this chapter described which processes could be linked between companies. According to Kim (2009) firms could develop supply chain capabilities in order to achieve sustained competitive advantage. These capabilities can be developed by combining resources that are: scarce, valuable and difficult to imitate (Barney et al, 2001).

The third chapter investigates in different levels of integration that can be achieved by companies in a supply chain. Frohlich and Westbrook (2001) developed a tool that describes the direction and intensity of the integration between companies. This resulted in five different ‘arcs of integration’. Muckstadt et al. (2001) identified three dimensions of supply chain integration and concluded four levels of supply chain integration based on these three dimensions. Finally, Lambert and Cooper (2000) concluded that companies should determine which business processes should be linked by adding management components to the link. The higher the number of management components, the higher the level of integration.

The fourth chapter describes how the level of integration influences the performance of the supply chain. Supply chain performance can be qualitative (service) and quantitative (financial) (Beamon 1998). The level of supply chain integration will lead to a higher supply chain performance if firms are able to develop competitive supply chain capabilities (Kim, 2009). And the goal of the integrated supply chain strategy is to create manufacturing processes and logistics functions across the supply chain as an effective weapon that cannot be easily duplicated by competitors (Tan, 2001).
CHAPTER 1: INTRODUCTION

Problem indication
In most industries it is not enough simply to optimize internal structures and infrastructures based upon business strategy. The most successful manufacturers seem to be those that have carefully linked their internal processes to external suppliers and customers in unique supply chains (Frohlich and Westbrook, 2001).

Supply chain management can be very important for achieving competitive advantage, because business management has evolved into internetwork competition (Lambert and Cooper, 2000). Supply chain management is a management perspective required to bring a product or service to the market by managing a network of companies as a single entity. Therefore integration of activities, functions and systems is required (Vickery, Jayaram, Droge and Calantone, 2003). It is reasonable to argue that the level and effectiveness of SC integration may influence how successful companies are regarding to the supply chain management practices; therefore supply chain integration might differ in scope and emphasis (Kim 2009). This statement is in line with Lambert and Cooper (2000) who argue that not all links should be closely coordinated and integrated but companies should seek for the relationship that bests fit circumstances.

Between 2002 and 2006 supply chain integration became a more important subject for scientific research. This is a result of a general trend within industries that are moving away from simple transactions and contractual based relationships toward long-term relational forms of collaboration between parties involved in the supply chain (Giunipero, Hooker, Joseph-Matthews, Yoon and Brudvig, 2008). Little is known about the connections between supplier and customer integration and improved operations performance (Frohlich and Westbrook, 2001). Supply chain integration became an important topic in the last decade for firms to achieve competitive advantage (Kim 2009, Giunipero et al., 2008 and Christopher, 2000) therefore the following problem statement is defined for this paper.

Problem statement
What types of relationships can be identified in a supply chain and what is the influence of the level of integration on the performance of the supply chain?

According to the research of Lambert and Cooper (2000), is it important to have an explicit knowledge and understanding about how the network structure is configured. It is important for firms to determine with which supply chain members to cooperate and which processes should
be linked. After determining the companies to collaborate with, it is important to determine the level of integration to each link.

In order to explore the problem statement more in depth, three research questions are formulated:

1. Which types of supply chain relationships can be identified and which processes could be linked between companies?
2. Which level of integration could be applied to each link between companies in the supply chain?
3. What is the influence of the level of supply chain integration on the performance of the supply chain?

**Relevance of the problem**

The success or failure of supply chains is determined in the marketplace by the end consumer. Getting the right product, at the right price, at the right time to the consumer is not only the key success factor to competitive success but also the key to survival. The performance of the supply chain is measured by how companies are able to match supply to demand whilst driving down costs and simultaneously improving customer satisfaction (Christopher and Towill, 2001). By thinking in terms of supply chains instead of individual operations or departments, executive officers can improve their competitive strategies. These strategies, in turn, change organizational operations, roles, and information systems (Ayers, 1999).

The academic relevance of this paper is best explained by Lambert and Cooper (2000) One of the suggestions in their research is to investigate in what determines the type or level of integration that should be applied to each process link. Kim (2009) adds that it seems reasonable to argue that the level and effectiveness of supply chain integration may influence the firm performance. Supply chain integration may differ in scope and emphasis, and the level of supply chain integration plays a strategic role in achieving success.

The managerial relevance is also pointed out in the research of Lambert and Cooper because their paper also argues that there is a need for developing normative tools for successful SCM practice. The importance of researching the level of integration within the supply chain is best described by (Vickery et al., 2003), they state that literature has shown that the performance of a supply chain increases when the degree of integration amongst the supply chain also increases.

**Research design**

Business research is an organized, systematic, critical and objective investigation into a specific problem. Business research is undertaken with the purpose to finding answers or solutions (Sekaran, 2003). This paper is a descriptive study after supply chain integration. A descriptive
study is used in order to be able to describe the characteristics of variables of interest in a situation. The goal of a descriptive study is to offer the researcher a profile or to describe relevant aspects of the phenomena of interest from an individual, organization or other perspective (Sekaran, 2003).

In order to conduct the descriptive business research in this thesis, a literature study is used. According to Sekaran (2003) a literature study is: “a comprehensive review of the published and unpublished work from secondary sources of data in the areas of specific interest to the researcher”. The purpose of a literature survey is to be sure that no variable that can have an impact on the problem is ignored.

For searching valuable information, several sources are used, e.g.: the Tilburg University information portal, ABI/Inform Global, Web of science, etc. Furthermore high quality journals are used as much as possible.

**Structure of the thesis**

Chapter one of this paper describes the problem indication, the relevance of the problem and the research design. Chapter two will discuss the different types of supply chain relationships and which processes could be linked between companies. Chapter three will discuss different levels of supply chain integration that firms can achieve. Chapter four describes the influence of the level of supply chain integration on the performance of the supply chain. Finally, chapter five will give the conclusions of this research, discussion and recommendation.
CHAPTER 2: TYPES OF SUPPLY CHAIN RELATIONSHIPS

In this chapter, the first research question will be answered: which types of supply chain relations can be identified?

2.1 WHAT IS SUPPLY CHAIN INTEGRATION?

Supply chain management is a management perspective regarding various activities, functions and systems required to bring a product or service to the market by managing a network as a single entity or system. This requires integration of activities, functions, and systems. An integrative supply chain creates value for the firm’s customers by means of integrated business processes (Vickery et al., 2003). Many problems that can appear in supply chain—such as parts shortages, delivery, and quality problems and cost increases—are caused by lack of effective internal and external supply chain integration. “By developing a high level of supply chain integration, manufacturers are able to identify and eliminate non-value added activities.” Supply chain integration can have the following benefits:

- Product quality;
- Delivery reliability;
- Process flexibility;
- Cost leadership.

(Kim, 2009).

Christopher (2000) came up with a more clear definition of integration and defined it as process integration. According to his research, this phenomenon is one of the important factors for supply chains to achieve agility. With process integration, meant collaborative working between buyers and suppliers, joint product development, common systems, and shared information. This form of cooperation is becoming very important for firms since firms are focusing more and more on core competencies and outsource all other activities. A big reliance on suppliers and alliance partners becomes crucial, factors like trust and commitment are very important. This also results in joint strategy determination, transparency of information, and open book accounting (Christopher, 2000).

Risk factors of supply chain integration

Supply chain integration also has risk factors such as conflicting objectives and mission, inadequate definition of customer service and separation of supply chain design from operational decisions (Tan, 2001). Frohlich and Westbrook (2001) added that there are inherent hazards of not fully integrating with supply chain partners. Manufacturers must not only manage
their own organizations but also be involved in the management of the network. Furthermore, trust and commitment are very important for achieving successful integration in the supply chain (Christopher 2000).

2.2 DIFFERENT SUPPLY CHAIN MEMBERS

Companies cannot establish intensive managed links with all companies in the supply chain. It is necessary for a focal company to identify who the partners of the supply chain are; including all potential partners may lead to a complicated network of companies. The key is to identify the type of partners who are critical to the value added activities (Min and Zhou, 2002). Lambert, Cooper and Pagh (1998) classified supply chain partners in two distinctive types: primary and secondary partners. This classification is based on the fact that a company interacts with all other companies in the network, either directly or indirectly through suppliers or customers. This classification will make the network of the focal company more manageable:

- Primary supply chain members are defined as follows: “All those autonomous companies or strategic business units who carry out value-adding activities (operational and/or managerial) in the business process designed to produce a specific output for a particular customer or market”.

- Supporting members are: “Companies that simply provide resources, knowledge, utilities, or assets for the primary members of the supply chain”.

Lambert et al. (1998)

Min and Zhou (2002) emphasize that the categories defined by Lambert et al. (1998) are not exclusive. For example, a firm can be a primary and supportive member at the same time when performing primary activities related to one process and supporting activities related to another. Although this distinction is not obvious in all cases, it allows the focal company to define further upstream or downstream members of the supply chain.

To exploit the benefits of linkages within the supply chain, characteristics of the linkages should be understood by the companies in the supply chain. Lambert et al. (1998) characterized four different types of process links:

**Managed process links:** These are links that are important to the focal company and should be integrated and managed well. These links mainly exist between the focal company and the tier 1 suppliers and customers. Although these links may also exist between the focal company and tier 2 suppliers or customers.
**Monitored process links:** These links are less critical to the focal company. However it is important to the focal company that these links are integrated and well managed between other companies in the supply network. The focal company has to make sure that these links are well managed and integrated by monitoring and auditing.

**Not-Managed process links:** Links that the focal company is not actively involved in. These links are not important enough to put effort in managing and monitoring, the focal company has to trust other partners. Examples of these types of links exist in the supplies of raw materials to the tier 2 suppliers. It is important for the focal company that these supplies are not interrupted but it is too costly to monitor all these flows.

**Non-Member process links:** These links are links between members of the network and non-members of the network (for example a competitor of the focal company). These links may influence, interrupt or disturb the supply chain structure of the focal company. But the focal company often has no influence on these links.

The four types of business process links are visualized in figure 1.

![Figure 1: Four Types of Business Processes in the Supply Chain](image)

**FIGURE 1 - FOUR TYPES OF BUSINESS PROCESSES IN THE SUPPLY CHAIN. LAMBERT ET AL. (1998)**

To answer the question why it is important to identify these four types of links Lambert et al. (1998) used an example. The example involved a company in the manufacturing of semi conductors. It turned out that six tier one suppliers in the network of manufacturing semi conductors, all purchased from the same tier two supplier. The tier two supplier had a critical role in the supply of the tier one suppliers to the focal company. Therefore it was important for this company to identify the critical links in the supply network.
Also Mentzer, DeWitt, Keebler, Min, Nix, Smith and Zacharia (2001) recognized the different linkages within supply chains, and their findings show comparisons with the findings of Lambert et al. (1998). In their article, Mentzer et al. (2001) defined a supply chain as: “a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances and/or information from a source to a customer”.

Based on this definition, Mentzer et al. (2001) identified three types of supply chain complexity: (1) a direct supply chain, (2) an extended supply chain and (3) an ultimate supply chain (figure 2). Each type of supply chain involves different partners. The first type only involves the immediate customers and suppliers. The second type involves all organizations involved in the upstream and downstream flows of products, services, information and finances. The third type of supply chain is very complex and involves different financial resource providers, logistic service providers or market research firms.

![Diagram of supply chain linkages](image)

**FIGURE 2 - TYPES OF SUPPLY CHAIN LINKAGES. MENTZER ET AL. (2001)**

Comparing these types of supply chains with the types of linkages of Lambert et al. (1998), some similarities can be identified. The direct supply chain of Mentzer et al. (2001) only involves managed process links. The extended supply chain also involves monitored process links and non-managed process links. Finally the ultimate supply chain includes all types of process links, including non member process links.

### 2.3 RESOURCES AND CAPABILITIES IN THE SUPPLY CHAIN

For each link in the supply chain, the most appropriate relationship should be chosen in a way that best fits circumstances. Which parties in the supply chain deserve attention by the management should be determined by the firm capabilities and the importance to the firm (Lambert and Cooper, 2000). Managing relationships based on supply chain capabilities is
supported by Kim (2009), who states that competitive advantage is based on two concepts: resources and capabilities. "Resources are those intangible and tangible assets linked to the firm in a semi-permanent way, whereas capabilities are related to the way of accomplishing different activities, depending on the available resources".

Kim (2009) developed a framework for linking a company's SC integration strategy to its competitive strategy based upon a research amongst Korean and Japanese manufacturing firms. The conceptual model for his research is based on the Resource Based View (RBV) of Barney et al. (2001). This RBV suggests that the resources of an enterprise are developed into capabilities which help the organization manage its environment and enhance performance. At the end the resources of a firm should be used and combined in order to generate hard-to-imitate capabilities that contribute to the competitive advantage. Companies that are able to manage resources in a supply chain more efficiently than their competitors are likely to gain competitive capabilities, this will lead to superior performance and increased competitiveness (Kim, 2009). Kim (2009) concludes that if companies within a supply chain are able to develop resources that are valuable, scarce and difficult to imitate, then they will most likely achieve sustained competitive capabilities. The resources on which companies can integrate are the following:

- Physical resources;
- Financial resources;
- Intangible resources;
- Organizational resources;
- Human resources.

Furthermore Kim (2009) mentioned that capabilities can be classified in supply side capabilities and demand side capabilities. In order to develop such supply chain capabilities based on specific firm resources, companies should integrate with other supply chain members. Through this integration, each firm in the supply chain can focus on their core competence and develop a particular area of expertise.

These findings are confirmed by Lambert and Cooper (2000). They state that "drivers for integration are situational and different from process link to process link". "The task of allocating scarce resources among the different business process links across the supply chain becomes crucial".
2.4 INTERNAL AND EXTERNAL INTEGRATION

In their research after integration intensity Rosenzweig, Roth, and Dean Jr. (2003) concluded that first departments, functions or business units within the firm that ‘source’, ‘make’ and ‘deliver’ products represent the enterprise entities in which internal integration occurs. This is depicted in figure 3. When a company becomes more and more dynamic, the need for internal integration increases simultaneously since more and more information must be processed among decision-makers to achieve performance. Further, Rosenzweig et al. (2003) found that at high levels of internal integration, higher-order organizing principles act as integrative mechanisms by which all internal groups are coordinated and knowledge is transferred. Once such integration has been achieved, "the firm exists as a community in which greater varieties of functional expertise can be communicated and combined to create knowledge".

![Diagram of Internal and External Integration](image)

**FIGURE 3 - INTERNAL AND EXTERNAL INTEGRATION. ROSENZWEIG ET AL. (2003)**

After attaining this internal integration, companies can begin to think about synchronized demand management, which is synchronizing demand from the customer with the manufacturing plan with the flow of materials from suppliers. Integration intensity also spans externally to the linkages with partners outside the focal company. This includes the network of direct tier one and tier two suppliers and customers (Rosenzweig et al., 2003). Kim (2009) adds that achieving integration within the supply chain a complex task that involves both internal and external parties such as vendors, customers and employees.

2.5 CONCLUSION

In this chapter the following question was researched: Which types of supply chain integration can be identified? Lambert et al. (1998) distinguished four types of supply chain members to the focal company: managed process links, not managed process links, monitored process links and non-member
process links. Also Mentzer et al. (2001) identified three types of linkages in supply chains. Companies can work together with only their direct suppliers and/or customers on one hand, but on the other hand, companies can also develop an extended network with different types of relationships and different products, services, information or finances supplied by each member of that network. This resulted in three types of supply chain complexity. In these three types of supply chain complexity, the four types of linkages of Lambert et al. (1998) can be identified because a direct supply chain, only involves managed process links, but on the other side an ultimate supply chain involves all four of the types of linkages.

The best type of linkage that companies could develop is that type that will result in supply chain capabilities. Capabilities are the ability of a company to develop resources that are valuable, scarce and difficult to imitate together with supply chain partners Kim (2009). Two types of supply chain capabilities are identified: supply side capabilities and demand side capabilities, furthermore Kim (2009) distinguished multiple different resources on which firms can integrate. Trough developing specific supply chain capabilities, firms can develop a specific area of expertise; this will result in a better supply chain performance.

Finally two different types of integration are identified according to Rosenzweig et al. (2003). It is important for firms, first to achieve a certain level of internal integration before companies are able to achieve external integration. The reason for this is that by internal integration, firms are becoming more dynamic and act as integrative mechanisms by which all internal groups are coordinated and knowledge is transferred.
CHAPTER 3: LEVELS OF SUPPLY CHAIN INTEGRATION

Integrating and managing all types of business process links in the entire supply chain is not appropriate. Because the motivation for integration is situational and different between each of the different process links; the level of integration should also differ from link to link and even over time. The reason for this is that some links are more critical than others (Lambert and Cooper, 2000). This shows the difference between types of links and the level of integration of each link. In this chapter, the level of integration of each link will be discussed.

3.1 ARCS OF INTEGRATION

In their paper Frohlich and Westbrook (2001) investigated supplier and customer integration strategies in a global sample of 322 manufacturers. This research resulted in the definition of different arcs of integration. An arc of integration is a graphical illustration of the direction (customer or supplier faced) and extend (degree of integration) at which shared activities can be developed (figure 4).

![Diagram](image)

**FIGURE 4 - THE ARC OF INTEGRATION. FROHLICH AND WESTBROOK (2001)**

The findings of this research suggest that all manufacturers implicitly make strategic decisions concerning the extend of upstream and downstream integration that they want to undertake. Some companies decide to engage in relatively little integration which results in a narrow arc of integration. Other companies decide to integrate extensively with their suppliers or customers; this results in a broad arc of integration. After conducting their research based on data from the International Manufacturing Strategy Survey (IMSS) Frohlich and Westbrook (2001) identified five different levels of integration intensity using the two dimensions ‘direction of integration’ and ‘extend of integration’:
**Inward-facing:** These companies do not focus on integrating with both suppliers and customers.

**Periphery-facing:** In this type of integration, companies have a non-extensive integration with both suppliers and customers.

**Supplier-facing:** By this type of integration companies have an extensive integration with suppliers and a non-extensive integration with customers.

**Customer-facing:** Companies focus on extensive integration with customers and non-extensive integration with suppliers.

**Outward-facing:** Companies on extensive integration with both customers and suppliers.

These five categories have both intuitive appeal and statistical validity in a large international database. This means that all participants of the survey intuitively agreed with the findings, but the findings were also statistically validated. Furthermore the broadest arc of integration was strongly associated with higher levels of performance based on the empirical evidence of this research.

### 3.2 FOUR LEVELS OF INTEGRATION ACCORDING TO MUCKSTADT ET AL (2001)

In order to realize the benefit of establishing collaborative linkages amongst the supply chain Muckstadt et al. (2001) established a set of guiding principles for supply chain partners. Their findings state that supply chain relationships should be established and managed differently from one another. They defined four categories of supply chain integration which may exist simultaneously in a supply chain because companies can treat their customers differently from their suppliers. For defining their categories Muckstadt et al. used three dimensions of supply chain integration: (1) Level of information systems integration, (2) Level of business process integration and (3) level of decision systems integration. These three dimensions resulted in four categories of supply chain integration:

**Communicators:** This is the most basic relationship, customers transmit orders to the firm and the firm is expected to respond to these orders. This is called a type four relationship.
**Coordinators:** When firms evolve and share more detailed data about operational activities such as inventory levels and customers' demand, a coordinating relationship exists. This is also called a type three relationship.

**Cooperators:** When companies start to communicate plans that influence the demand or capacity of the firm where partners have to deal with, a type two relationship exists. Achieving this level of interaction requires a sustainable information infrastructure and supporting business processes.

**Collaborators:** When companies carefully plan capacity and decide jointly where and in what quantities inventories of various types should exist, a type one relationship exists. Companies must also decide in advance what actions will be taken when various unplanned events occur. Strategic and tactical plans must be created collaboratively to achieve maximum effectiveness.

The four categories of supply chain integration are explained in figure 5.

This figure suggests that firms that do not have integrated their information systems with supply chain partners, will not be able to integrate on the level of decision systems and thus will achieve the highest possible level of integration.

The reason for firms to integrate with certain partners is to focus on the core competence. There has been a shift in management focus and strategy toward decreasing operations in order to focus on the firms' core competencies. Firms used to integrate vertically more and more; however, presently the focus on the core competence resulted in a disintegration of a firm's internal supply chain. Therefore different levels exist according to Muckstadt et al. (2001)
3.3 THE LEVEL OF SUPPLY CHAIN INTEGRATION AS A FUNCTION OF MANAGEMENT COMPONENTS

In their study, Lambert and Cooper (2000) found that the level of supply chain integration with specific partners depends on the number of business processes that are integrated. In other words: “the level of supply chain integration is a function of the number and level of the types of linkages between companies” (Lambert and Cooper, 2000).

First Lambert and Cooper (2000) defined nine different types of linkages between companies which are called 'management components'. These nine different management components are divided into physical & technical management components and Managerial & Behavioral management components. The nine management components are visualized in figure 6.

![Figure 6 - Management Components](image)

Lambert and Cooper (2000) continue their conclusions by arguing that the more management components are added to the link between two companies, the higher the level of supply chain integration. Also within each component the level of integration can differ, for example two companies can emphasize on planning and control mechanisms and be fully integrated on this single aspect while other aspects are not integrated at all.

The management components are divided into the two groups. The first group of components is: visible, tangible, measurable and easy-to-change. The second group of components is: less tangible and visible and therefore difficult to change. The difference between these two types of integration is recognized by Mentzer et al. (2001) by identifying a functional scope on supply chain management and an organizational scope of supply chain management. The functional scope can be compared with the physical & technical management components because this refers to the combination of functions to get a specific output of the supply chain. The organizational scope can be compared with the managerial & behavioral management components because this scope emphasizes managerial and organizational aspects of the supply chain (Mentzer et al., 2001).
However the managerial management components are very important for a successful integration between companies. If these components are not aligned to drive the organizational behavior towards supply chain objectives, the supply chain will likely be less competitive (Lambert and Cooper, 2000). This statement is supported by Rosenzweig et al. (2003) who defined that a company should be first integrated internally before external integration can be achieved.

3.4 CONCLUSION

According to Lambert and Cooper (2000), companies should first determine what type of business processes are linked with supply chain members. Then the level of integration of each link can be determined, because it is impossible to manage all links at the same level.

In determining the level of integration, Frohlich and Westbrook (2001) found five different levels of supply chain integration, called arcs of integration. An arc of integration is a graphical illustration of the direction and intensity of the integration between the focal company and their supply chain members. Frolich and Westbrook (2001) suggest that all manufacturers implicitly make strategic decisions concerning the level of upstream and downstream integration they want to undertake. Their research resulted in the following levels of integration: (1) Inward facing, (2) periphery facing, (3) supplier facing, (4) customer facing and (5) outward facing.

Also Muckstadt et al. (2001) researched the level of integration between companies. This research resulted in four different levels of supply chain integration based on three dimensions of supply chain integration. These dimensions are: (1) level of information systems integration, (2) level of business process integration and (3) level of decision systems integration. These three dimensions resulted in a matrix which suggests that companies that do not have integrated their information systems, will never be able to integrate on a decision system level. Muckstadt et al. (2001) defined four levels of supply chain integration: (1) communicators, (2) coordinators, (3) cooperators and (4) collaborators. Unlike the findings of Frohlich and Westbrook (2001), this model does not look at the direction of integration, but only on the intensity of integration. However, Muckstadt et al. (2001) concluded that the different levels may exist simultaneously in a company’s network, for example when a company treats its customers and suppliers differently.

Finally, the level of integration is a function of the number of types of linkages according to Lambert and Cooper (2000). First they defined nine different management components on which companies can integrate, these components are divided into managerial components and
physical & technical components. The more components, companies have synchronized, the higher the level of supply chain integration. These conclusions are in line with the conclusions of Muckstadt (2001) because the managerial management components are similar to the decision systems integration and the physical & technical components are similar to the business process and information systems integration. Remarkable in the findings of Lambert and Cooper (2000) is that they did not define specific levels of integration. Where Frohlich and Westbrook (2001) identified five levels of integration and Muckstad et al. (2001) came to four different levels of supply chain integration; Lambert and cooper stated that any level of integration can be achieved, depending on the number of management components that are added to the link.
CHAPTER 4: THE INFLUENCE OF THE LEVEL OF SUPPLY CHAIN INTEGRATION ON THE PERFORMANCE OF THE SUPPLY CHAIN

This chapter will answer the third research question: what is the influence of types and levels of supply chain integration on the performance of the supply chain? First the concept of performance will be researched, secondly, the influence of supply chain integration on performance.

4.1 PERFORMANCE OF THE SUPPLY CHAIN

Supply chain performance is an important component in supply chain design and analysis. A number of performance measures are important for the evaluation of supply chain effectiveness. These measures can be either quantitative or qualitative (Beamon, 1998). According to Vickery et al. (2003) the objective of an integrated supply chain strategy is to synchronize the requirements of the final customer with the materials and information along the supply chain in order to find the balance between customer service and costs. So Vickery et al. (2003) argue that supply chain performance has two dimensions: (1) service performance and (2) financial performance. Customer service is defined as the coverage of many service dimensions that are both general as well as manufacturing service objectives. Financial performance is defined by the traditional performance measures which include Return on Assets (ROA), Return on Investment (ROI) and Return on Sales (ROS). Costs are a very important part of these financial performance indicators. Although, Vickery et al. (2003) define two dimensions of firm performance, they also recognized that at the end, financial performance is the most important performance. Kim (2009) goes further in defining the performance of a supply chain and identifies four dimensions: (1) cost, (2) quality, (3) flexibility and (4) time performance. Both identify one financial dimension of supply chain performance. However, Vickery et al. (2003) specify the financial dimension into different performance indicators. Beamon (1998) classified the service performance as qualitative and the financial performance as quantitative.

4.2 DEVELOPING SUPPLY CHAIN CAPABILITIES

Based on the findings of Kim (2009) firms should integrate in the supply chain by combining resources in order to develop supply chain capabilities. In other words, firms should develop a type of linkage that provides a unique position in the market and capabilities that competitors do not have. Kim (2009) did a research amongst Korean and Japanese car manufacturers. The research concluded that developing supply chain capabilities will lead to supply chain performance. Their research model explored the indirect relationship between supply chain
integration and supply chain performance. The research model of Kim (2009) is showed in figure 7.

Remarkable in the outcomes of the research is that amongst the Japanese manufacturing firms, this model was significant, but amongst the Korean firms, this model was not significant. The cause of this effect may be found in the size of the firm. The Korean firms in the sample were smaller than the Japanese firms, which causes the indirect effect of supply chain integration on performance of the supply chain. This means that the level of integration is more important for small firms and the supply chain integration is an intermediate factor for the linkage of supply chain practices and performance of the firms involved. However, this does not mean that in large firms, supply chain integration is not important (Kim 2009).

Also Rosenzweig et al. (2003) identified the mediating role of supply chain capabilities in the relationship between supply chain integration and supply chain performance. In this model, also the size of the firm is researched as a factor in the model. Rosenzweig et al. (2003) stated that integration is required to efficiently handle the increased amounts of complexity and uncertainty in the hypercompetitive consumer products sector. Highly integrated firms are able to obtain more competitive advantage than independent firms in two ways: (1) due to increased information visibility and operational knowledge these companies are more responsive to volatile demand patterns and (2) highly integrated firms have potential to lower costs of the total operation.

Also Rosenzweig et al. (2003) researched the relationship of developing capabilities in supply chain integration. Different types of capabilities are defined by Rosenzweig et al. (2003): quality capability, reliability capability, flexibility capability and the cost leadership capability. The different capabilities are explained:

**Quality capability**: Based upon the Total Quality Management (TQM) theory, which states that companies are not able to continuously supply high quality products without effective collaboration among the supply chain. When supply chain partners emphasize their own goals at the expense of their partners, the relationship may be sub-optimized.
**Reliability capability:** This capability depends upon the consistent on-time receipt of the correct number and type of products (parts, raw materials) from suppliers and the amount of time that customers are willing to wait for products and services.

**Flexibility capability:** High level of integration are necessary for developing flexible operations. Flexibility is important in the hypercompetitive environment in which frequent changes in volume, product mix and schedules occur.

**Cost leadership capability:** Cost leadership enables manufacturers to be more price responsive and to gain higher margins than competitors due to lower costs. Integrated manufactures are able to save more costs than less integrated companies. By increasing communication, cooperation and coordination, firms were able to reduce costs. (Rosenzweig et al., 2003)

Next, the firm capabilities are linked to business performance. Linking capabilities to business performance will enhance a company's chances for growth and survival this is depicted in figure 8 (Rosenzweig et al., 2003). Also this model concludes that the size of the firm affects the degree in which companies are able to develop competitive capabilities and therefore achieve a better supply chain performance.

![FIGURE 8 - RESEARCH MODEL. ROSENZWEIG ET AL. (2003)](image)

Also Frohlich and Westbrook (2001) concluded that supply chain integration will lead to performance. However, they distinguished between two types of performance: the customer service performance and the financial performance. The broadest arc of integration will have the largest performance outcome, with respect to customer service, on-time delivery, delivery lead time, productivity, quality and cost. These performance outcomes will result in overall firm performance: market share and profitability. According to Tan (2001) is the goal of the integrated supply chain strategy to create manufacturing processes and logistics functions across the supply chain as an effective weapon that cannot be easily duplicated by competitors.
CHAPTER 5: CONCLUSION

This chapter will give the conclusions of this research and give answer to the problem statement of this literature review.

5.1 CONCLUSION

The costs of running a relationship between companies are called transaction costs and include the costs associated with negotiating, monitoring, adjusting, enforcing and terminating exchange agreements between firms. A transaction occurs when a good or service is transferred between two separate units in the supply chain (Williamson, 1985). According to the transaction cost theory, firms can choose either to purchase inputs for production, or to make them (vertical integration). The transaction costs theory indicates that transaction costs rise as uncertainty in the environment and transactions between firms increase. This theory predicts that as the relationship between companies moves from discrete to long term or even vertical integration, environmental uncertainty increases and the frequency of transactions increase. Therefore the transaction costs will also increase (Carr and Pearson, 1999). The transaction cost theory results in simple transactional and long-term relational forms of collaboration between parties involved in the supply chain. The development of long term, strategic relationships between buyers and sellers within the supply chain has shown opportunities to create competitive advantage. Therefore, supply chain integration is a good alternative to the traditional transaction cost theory (Giunipero et al. 2008). When firms start developing such long term buyer-supplier relationships; issues such as trust, effective communication and information and asset sharing become very important. Developing these supply chain management strategies will lead to creating competitive advantage and improve the buyer supplier relationship in connection with supply chain performance (Giunipero et al. 2008). The importance of supply chain integration is that firms are able to focus on their core competence while simultaneously driving down the costs of operations and transactions (Muckstadt et al. 2001) The problem statement of this literature review is defined as follows:

What types of supply chain integration can be identified and what level of integration should be applied to each link in order to achieve a better supply chain performance?

The main objective of this problem statement was to investigate what the influence of supply chain integration on supply chain performance was. Supply chain performance has multiple definitions but researchers agree that in the end, financial performance is the most important performance dimension.
The research after types of supply chain integration is involved because of the findings in literature that argue that it is impossible for firms to collaborate with all supply chain partners with the same intensity (Lambert et al., 1998, Min and Zhou, 2002 and Kim 2009). Lambert et al. (1998) defined four types of linkages that can appear between companies in a supply chain:

- Managed process links;
- Monitored process links;
- Not-managed process links;
- Non-member process links.

The relevance of these four types comes from the fact that not all firms are important to the focal company. However, some firms have to be taken into account because they might affect business processes in the focal company.

In addition, Mentzer et al. (2001) identified three degrees of supply chain complexity that firms can achieve. The first type is a direct supply chain, where the focal firm only takes relationships with tier one suppliers and customers into account. In the second type of supply chain complexity, also firms further upstream or downstream in the supply chain are recognized as collaboration partners, this type is called an extended supply chain. Finally, Mentzer et al. (2001) defined the ultimate supply chain which is very complex and involves different resource providers. The findings of Mentzer et al. (2001) can be compared to those of Lambert et al. (1998) because both the researches conclude different types of relationships that can be recognized in the supply chain. The difference between these types is that Mentzer et al. (2001) defined their conclusions as degrees of supply chain complexity which means that firms can evolve from a direct supply chain through an extended supply chain into an ultimate supply chain.

In this definition supply chain management is considered as a management philosophy which means that supply chain management is a set of beliefs that each firm in the supply chain directly and indirectly affects the performance of all the other supply chain members. On the other side, Lambert et al (1998) just identified the types of linkages and did not classify them into degrees of complexity.

Next to identifying different types of relationships between companies in a supply chain, the second chapter of this paper also identified different types of supply chain integration. Rosenzweig et al. (2003) concluded in their research that companies should first integrate internally before external supply chain integration can be achieved. The reason for this is that firms with a higher degree of internal integration are more dynamic and exist as a community in which great varieties of functional expertise can be communicated and combined to create knowledge. The second step after determining the supply chain network structure is to determine which processes should be linked between companies (Lambert and Cooper, 2000).
Companies can develop supply chain capabilities by using the resource based view of Barney et al. (2001). Competitive advantage is based on resources and capabilities (Kim, 2009). "Resources and capabilities can be viewed as bundles of tangible and intangible assets, including a firm’s management skills, its organizational processes and routines, and the information and knowledge it controls". Sustained competitive advantage derives from resources that are valuable, rare, imperfectly imitable and not substitutable (Barney et al. 2001). Also Lambert and Cooper (2000) conducted research after which processes could be linked between companies. According to their research, it became clear that in some cases the internal business processes have been extended to suppliers and managed to some extend between the firms involved. This may imply that when a leadership role is taken, the internal business processes of a firm can become supply chain business processes. The number of business processes that is critical and/or beneficial to integrate and manage between companies will likely vary. In some cases it might be appropriate to link just one key process and in other cases multiple are linked (Lambert and Cooper 2000). The processes that can be linked between companies are called management components. In the research, nine management components are defined:

- Planning and control;
- Work structure;
- Product flow facility structure;
- Information flow facility structure;
- Information flow facility structure;
- Management methods;
- Power and leadership structure;
- Risk and reward structure;
- Culture and attitude.

The level of integration is a function of the number of components that are added to the link (Lambert and Cooper 2000). Also Muckstadt et al. (2001) identified different levels of supply chain management. According to their research four levels of integration can be achieved:

- Communicators;
- Coordinators;
- Cooperators;
- Collaborators.

The level of integration depends on: the level of information systems integration, the level of business process integration and the level of decision systems integration (Muckstadt et al. 2001). Also Frohlich and Westbrook (2001) defined different levels of supply chain integration, which are called arcs of integration. The difference with their conclusions and the findings of Muckstadt et al. (2001) is that they differentiated between the direction and intensity of
integration, where Muckstadt et al. (2001) only focused on intensity. Frohlich and Westbrook (2001) identified five types of supply chain integration:

- Inward-facing;
- Periphery-facing;
- Supplier-facing;
- Customer-facing;
- Outward-facing.

When firms are able to combine resources and develop sustainable capabilities through supply chain integration, will this lead to performance of the supply chain (Kim, 2009). Supply chain capabilities have a mediating role in the relationship between supply chain integration and supply chain performance. Four types of capabilities can be identified in a supply chain relationship:

- Quality capability;
- Reliability capability;
- Flexibility capability;
- Cost leadership capability.

Linking these capabilities to business performance will enhance a company's chances for growth and survival (Rosenzweig et al., 2003). According to Frohlich and Westbrook (2001) will supply chain integration lead to performance. Although the broadest arc of integration will lead to customer service performances as on time delivery, productivity, quality etc. This performance will lead to overall firm performance in terms of market share and profitability. Also Vickery et al. (2003) identified the fact that integration will lead to financial performance with the customer service performance as a mediating factor. Thus the direct path from supply chain integration to financial performance is only significant when it goes indirect through customer service.

Answering the research question of this paper, it can be concluded that a higher level of supply chain integration will lead to a better firm performance. However, according to Kim (2009) and Rosenzweig (2003) are supply chain capabilities the mediating construct in this relationship. But according to Frohlich and Westbrook (2001) and Vickery et al. (2003) is service performance the mediating construct. According to Tan (2001) a higher level of integration will also lead to more effective competitive advantage.

5.2 DISCUSSION

One of the papers from which a lot of conclusions are drawn for this literature research is the research after ‘issues in supply chain management’ of Lambert and Cooper (2000). This paper
was a very useful tool and guideline for the objectives of this paper. The disadvantage of using this paper as a guideline is that the research of Lambert and Cooper might be considered as outdated because it is published in 2000. Furthermore, also the research of Frohlich and Westbrook (2001), Rosenzweig (2003) and Lambert et al. (1998) are frequently used for this research. Also these papers might be considered as outdated.

On the other side, the research of Giunipero et al. (2008) researched a decade of SCM literature and concluded that between 2002 and 2006 a general trend existed from arms-length relationships between companies towards more long-term relational forms of collaboration. And Kim (2009) concluded that the emphasis on systemic supply chain integration may be crucial in the early stage of supply chain management. In the stage after setting supply chain integration, firms should focus on the high level of consistency between supply chain strategy and competitive strategy. The conclusions of these two researches show that integration is a trend in supply chain management.

5.3 RECOMMENDATION

According to the findings in this paper, it is clearly pointed out that higher levels of supply chain integration will lead to a better supply chain performance. The aim of integrating successfully is to develop competitive supply chain capabilities with supply chain partners. Therefore, firms should consider different members that play a role in a supply chain. Supply chain integration will lead to a clear focus on the core competence of the firm and eliminate problems such as parts shortages, quality problems, cost increases etc.

Suggestions for future research are to investigate in clear steps to implement supply chain integration. Some researchers do not agree on the definitions of supply chain management and describe it as a management philosophy on a strategic level that goes further than just logistics. On the other hand supply chain management can be considered as a set of activities where firms must establish management practices to behave consistently with the objectives of the supply chain (Mentzer et al., 2001) Tan (2001) agrees by arguing that there is no explicit description of supply chain management or its activities.

Furthermore, the size of the firm is concluded to be an influencing factor for the need of integration by Rosenzweig et al. (2001) and Kim (2009) the effects of this influence should be explored more in depth because it is important for firms to know in what degree supply chain integration is important for their firm.

Finally, the disadvantages of supply chain integration are just mentioned in this research, but not explored more in depth. It is important for firms to be aware of the downsides of strongly integrated relationships with supply chain partners.
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