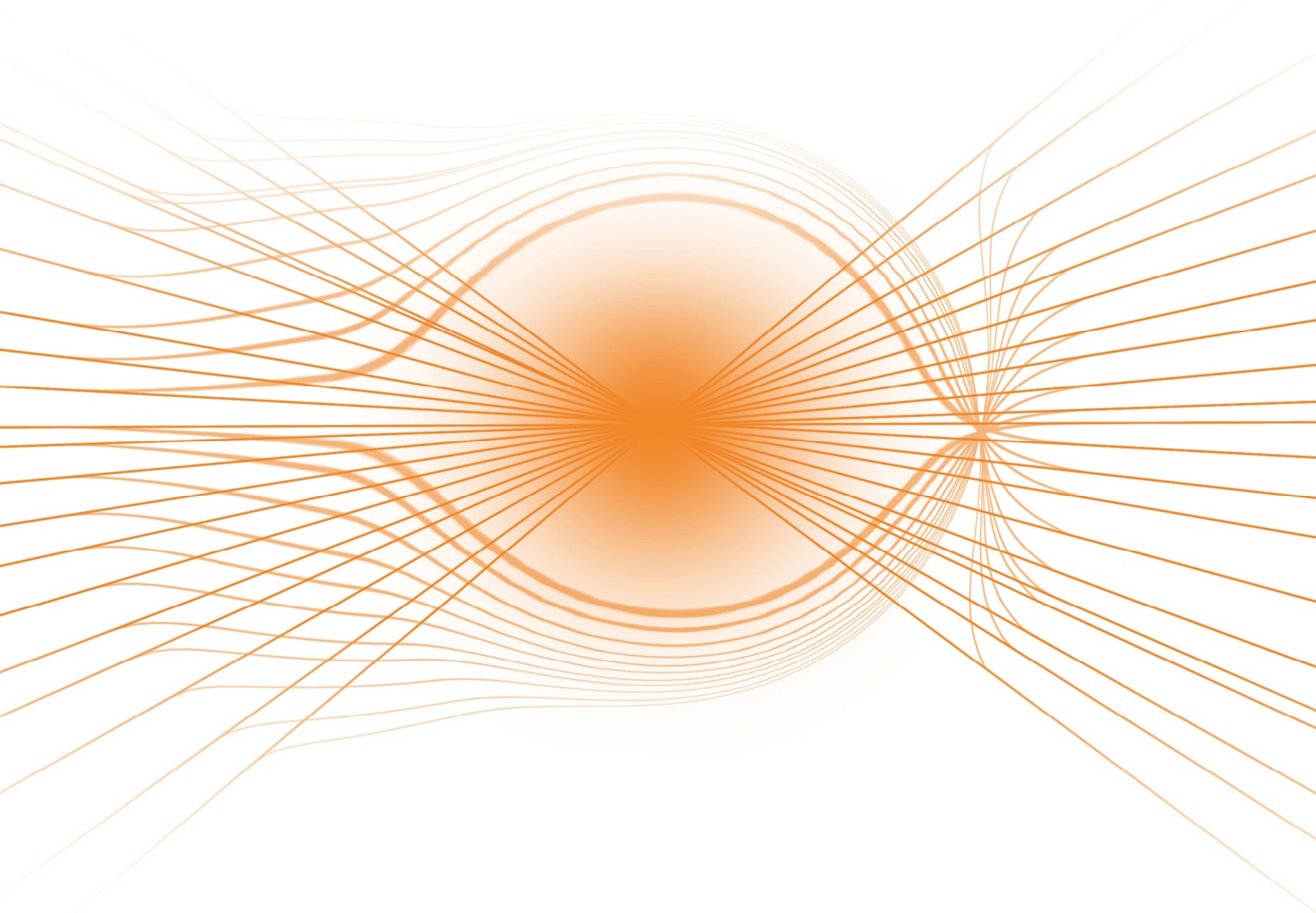
Supply Base Structuring

Introducing the Supply Network Model



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PREFACE

Purchasing and supply management has become an area of strategic importance over the last decades. The development has been characterized by an increasing professionalism and by growing demands on highly educated engineers and economists. At the same time, the field has become subject to academic interest and is now an established research area at many universities.

The book describes some important dimensions of this development as it focuses on how companies work strategically with their supply bases, and on the theoretical models that have been used in these endeavors. Beginning with the well known Kraljic model, introduced in 1983, the book describes how the model has been developed by researchers and how companies have become increasingly 'strategic' in their approaches to managing their supply bases. Starting in a rather narrow focus on the products subject to purchasing and supply, the development continues into a focus on supplier relationships. In the last chapter of the book the authors present their suggestions of the next step in this development by introducing a new model: The Supply Network Model. The model is based on the notion of supply networks and addresses how and why supplier relationships can be connected or integrated by the buying firm in order to improve the performance of the supply base.

The book has been written by six students taking part in the Master's program *Supply Chain Management* and is the outcome of an advanced course in *Purchasing and Supply Management*. The course and the book could not have been realized without the support of purchasing managers at three companies who kindly contributed their time for guest lectures and interviews. We are also grateful to two reviewers: Professor Ann-Charlott Pedersen at the Norwegian University of Science and Technology and Professor Arni Halldorsson at Chalmers, who will comment on the book in order for us to continuously improve the course design.

Professor Anna Dubois
Examiner

PhD student Nojan Najafi
Teaching assistant

Gothenburg, December 2011

ABSTRACT

The handling of a company's supply base is of great importance in today's business environment. The importance of purchasing has increased due to outsourcing activities and an increased focus on core competencies. In order to increase the efficiency of the purchasing activities the supply base can be structured in different ways. The main strategic choice has been between single and multiple sourcing strategy, or variants of the two. Other popular ways to structure the supply base has been by dividing the products into different categories, and then choose a strategy according to what category the product has been divided into. This concerns choosing the number of suppliers and how to organize them. For this, using portfolio matrices has become popular and started with Kraljic's purchasing portfolio matrix introduced in 1983. The purchasing portfolio model is a four step model aiming at examining how to exploit purchasing power for the purchased items based on two factors; the supplier market's complexity and the strategic importance of the purchase. These two factors result in four boxes depending on how the two factors are combined, the boxes are: non-critical items, leverage items, bottleneck items and strategic items. Since the introduction of the Kraljic's matrix in 1983 there has been many variants made of it, where the most famous include Olsen and Ellram's (1997) matrix that includes relationships, Bensaou's (1999) that uses buyer and supplier investments to handle the purchase situation and Gelderman's (2003) which provide some new perspectives on buyer-seller dependencies as well as the resource dependency.

However, the business climate as we know it changes rapidly, and since the introduction of Kraljic's matrix many trends have impacted on the business climate, changing the rules for purchasing. These trends can be divided into *mega trends*, *market trends* and *business trends* depending on their width. In the *mega trends* an increasing oil price can be seen as well as increasingly short supply of rare earth elements, shifting center of gravity and access to capital becoming more restricted. The *market trends* include customization of physical products, such as modularization and postponement strategies, and also differentiation by service. Finally the *business trends* encompass outsourcing, increased focus on core competence which increase the complexity in the supply chain as well as an increased focus on servitization.

Considering all these new trends since the introduction of Kraljic's purchasing matrix, and the issues they bring regarding complexity, variety and heterogeneity, it can be concluded that Kraljic's matrix, focusing on products, in most cases does not encompass all the issues necessary to handle in today's purchasing environment. Neither the variants of Kraljic's matrix, focusing on the importance of relationships, are sufficient. Therefore we found a need to develop a new model that takes the identified trends into account and focus on the entire supply base.

The new model is called The Network Model and aims at providing companies with a supply base strategy model for choosing and creating an appropriate network for their supply need. The model is cyclic and includes five steps, *map, evaluate, match, develop* and, *maintain.* The first step is done in order to *map* the company's supply base assets by using the *Activities, Resources and Actors* (ARA) *model*. The company's own network is then *evaluated* by using a matrix, created to examine the network's horizontal and vertical integration, in order to categorize the network into one out of four quadrants of the matrix. The categorization will then help the company to *match* its supply network needs to another appropriate network in order to fulfill the unfulfilled needs of their network. In the *develop* step the company ties the

appropriate network to them by creating actor bonds in order to combine resources and connect activity links. *Maintain* is where routines are made in order to keep the network working effectively and efficiently. Since relationships are not static and tend to change over time, as well as the demand for products tend to follow a maturity curve, this process needs to be repeated in order to keep the network efficient and up to date.

ACKNOWLEDGEMENT

This book is the result of the joint efforts of the participants of the course Purchasing and Supply Management which is held at Chalmers University of Technology. By sharing ideas in brainstorming sessions, giving feedback to each other and, co-writing the chapters in the book the group has reached a fantastic result which would have not been possible for each person individually. This course has given us the possibility to use and extend our knowledge and skills within the field of our master studies in supply chain management.

We would like to give a special thanks to Henrik Nilsson the designer of the book's amazing cover page.

Further we would like to express our gratitude to the interviewed people who were willing to share their time, knowledge and information. This helped us add another dimension to the book and reach a higher level of understanding. A special thanks therefore goes to Johanna Malkan Nyberg and Johan Larsson at Skanska, Jenny Lilliehöök and Andreas Gustafsson at Volvo Powertrain and, Viktoria Wennberg, Mikael Kylberg and AnnChristine Strigén at Mölnlycke Health Care.

Last but not least we would like to thank the division of Industrial Marketing at Chalmers University, Anna Dubois and Nojan Najafi for making this course possible. Nojan Najafi gave us technical support for the book whenever we needed. Anna has provided great support and guidance during the course without imposing on which direction we should take.

The purchasing and supply management group,

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ABOUT THE AUTHORS

Christopher Lövgren has a bachelor's degree in Mechanical Engineering and is currently studying the master´s program Supply Chain Management at Chalmers University of technology which he will graduate from in the spring of 2012. After the completion of his studies he is hoping to start his career as a logistic consultant to further develop and apply his knowledge within the logistic and supply chain area.

David Magnusson took his bachelor's degree in Industrial Engineering and Management at Chalmers University of Technology. After having experienced the purchasing profession through summer jobs, he took interest in Supply Chain Management and decided to join the SCM master's program at Chalmers. David also has experiences from working part time as a logistics consultant parallel to his studies. He will be finished with his studies by the summer of 2012 and aims at a career within supply chain management.

Helena Nilsson holds a bachelor's degree in Industrial Engineering and Management from Chalmers University of Technology. Pursuing her interest in logistics and purchasing Helena is now studying the master's program Supply Chain Management. Helena was part of the winning team of SCM's case competition 2010 and reached a third place in the following competition in Arkansas, USA. During the spring of 2012 she will write her master thesis for Skanska. After graduation Helena hopes for a career within the area of Supply Chain Management.

Paul Simonsson also holds a bachelor's degree in Industrial Engineering and Management from Chalmers University of Technology. He partakes in the same master's program as the co-authors. The dedication to supply chain management originates from an interest in production logistics as a result of long-term service at Volvo Trucks. Experiences within the field of supply chain management have also been gained by performing production development projects as a management consultant.

Linda Skogman has a bachelor's degree in Industrial Engineering and Management. She is studying the master's program Supply Chain Management and will hold her master's degree by the summer of 2012. She has previous experience from working in the field of logistics during the summers of 2010 and 2011 and has also been part of the winning team of SCM's case competition, as well as ended on third place in the following case competition in Arkansas, USA, in 2010. Linda is aiming at a career in the field of Purchasing within Supply Chain Management.

David Sätterman has a bachelor's degree in Mechanical Engineering from Chalmers University of Technology. He is currently studying in the master's program Supply Chain Management and will graduate during the spring 2012. David has experience within the field of supply chain management from company internship and is the winner of "Studentpriset 2011" in the category "Logistics". In the beginning of January 2012 he will start writing his master's thesis for Scania CV.

TABLE OF CONTENTS

FIGURES AND TABLES

INTRODUCTION

This introduction will introduce the subject of the book as well as the content of the book. It will also present short descriptions of the companies that will provide mini-cases throughout the book. A short presentation of the book's four chapters is also provided.

BACKGROUND

Purchasing has been a part of companies' businesses for a long time. In the book "On the Economy of Machines and Manufactures" it is written about "materials men" who "selects, purchases, receives and delivers all articles required" as one of the key employees when running a mine (Babbage, 1832). Much has happened since then and purchasing has become more and more important with purchasing costs rising to around 50 percent for the whole industry sector in the United States and Sweden and even up to 70 to 80 percent in some sectors by the year of 2000 (Gadde et al., 2010). Also the development of low cost countries has further increased the role of purchasing since outsourcing to these countries challenges the established procedures to purchasing operations due to the low production costs (ibid.). This has furthermore enabled developed countries to become more industrialized and competitive which further increase the challenges for modern companies (ibid.).

Traditionally purchasing has been seen as events isolated from other parts of the company with the only focus to reduce prices. However, this usually means that new suppliers will be added to the supplier base on a regular basis which thus increases the indirect costs such as administrative handling costs (Gadde et al., 2010). Traditionally suppliers were generally not encouraged to make use of their unique capabilities and contribute to the development of new innovations that could benefit the buyer. Also, since the focus has been to reduce direct costs the total costs have been neglected. This strategy is short sighted and could lead to long-term problems.

Today many firms have started to focus on reducing the total cost and not only the direct costs (Gadde et al., 2010). The focus on core competence have also affected purchasing, and buying firms have begun to more and more take advantage of the suppliers' capabilities in both product development and specialized resources (ibid.). This has in turn increased the importance of developing strategic relationships with key suppliers. In order to develop these relationships larger focus have been placed on evaluating the firm's supply base and developing strategies for how to handle the supply base structure. Several models have been developed in order to help manage a firm's supply base and some have become widely adopted throughout the industry. With the reduction of suppliers and a larger focus on strategic relationships with suppliers; companies hope to stay more competitive.

OUTLINE TO THE BOOK

The focus of this book is to present key concepts, wide spread strategies and general trends in order to present a newly developed model based on these findings. The new model will be based on the discussions and findings presented throughout the book and it will be based on current trends and demands. Real life examples from successful companies within several industries will also be provided throughout the book.

The topics brought up in the chapters of this book have been chosen by the students of the purchasing management class and are related to the theme of supply base structuring. The aim of the book is not to provide an exhaustive coverage of the topic but instead give an overview of some of the key areas in this interesting and important topic.

The first three chapters aim to provide a background and context for the new model developed in the fourth chapter, see Figure 1. The first chapter presents important concepts and provides background to the topic. The chapter is a good starting point towards the second chapter. The second chapter presents several different matrix portfolios with largest focus placed on Kraljic (1983). It does not aim to be exhaustive on all developed matrix portfolios but instead provide a departure towards the fourth chapter. Chapter 3 describes different trends that have affected purchasing and supply base structuring. It provides a framework on important aspects that should be considered in the fourth chapter. In Chapter 4 a new model is presented with a different focus than the models presented in Chapter 2. This model use the concepts, real life examples and trends presented in the earlier chapters in order to analyze and develop the supply base network.

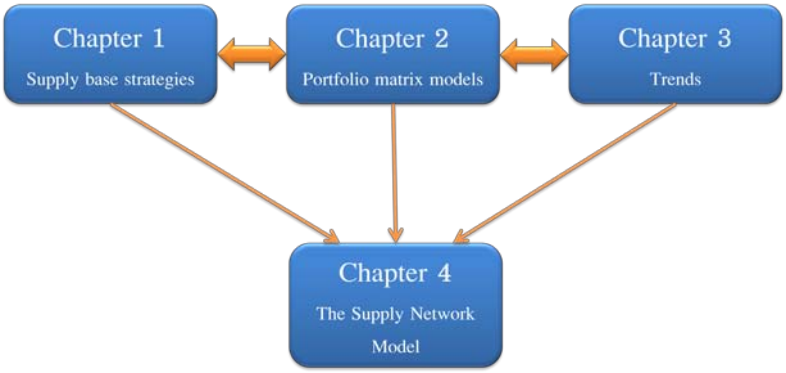


Figure 1. Book outline and structure

COMPANY INTRODUCTION

For this book interviews with three companies in different industries with different purchasing strategies have been conducted. Small mini-cases from these three companies will follow through all chapters in the book and tied to the concepts presented. General descriptions of the companies are provided below and a more specific introduction of their purchasing strategies will be introduced in Chapter 1.

MÖLNLYCKE HEALTH CARE

Mölnlycke Health Care is a global provider of health care solutions and is a big supplier of health care material, mostly single-use surgical and wound care products, to hospitals and local treatment centers. The company's over 7000 employees are distributed worldwide among nine manufacturing facilities in Europe, Asia-Pacific and USA and 30 sales offices in Europe, Asia-Pacific, USA, the Middle East and Africa, thus providing sales to 80 countries. In 2010 the revenue was 949 MEUR with Europe, the Middle East and Africa (EMEA) as the largest contributor with 74% of sales. However North America (22%) and Asia Pacific (4%) show strong sales growth. The company's products are categorized under one of the two business units Wound Care or Surgical. Mölnlycke Health Care has three core values which should guide their employees in their everyday work: Passion, Learning and Integrity.

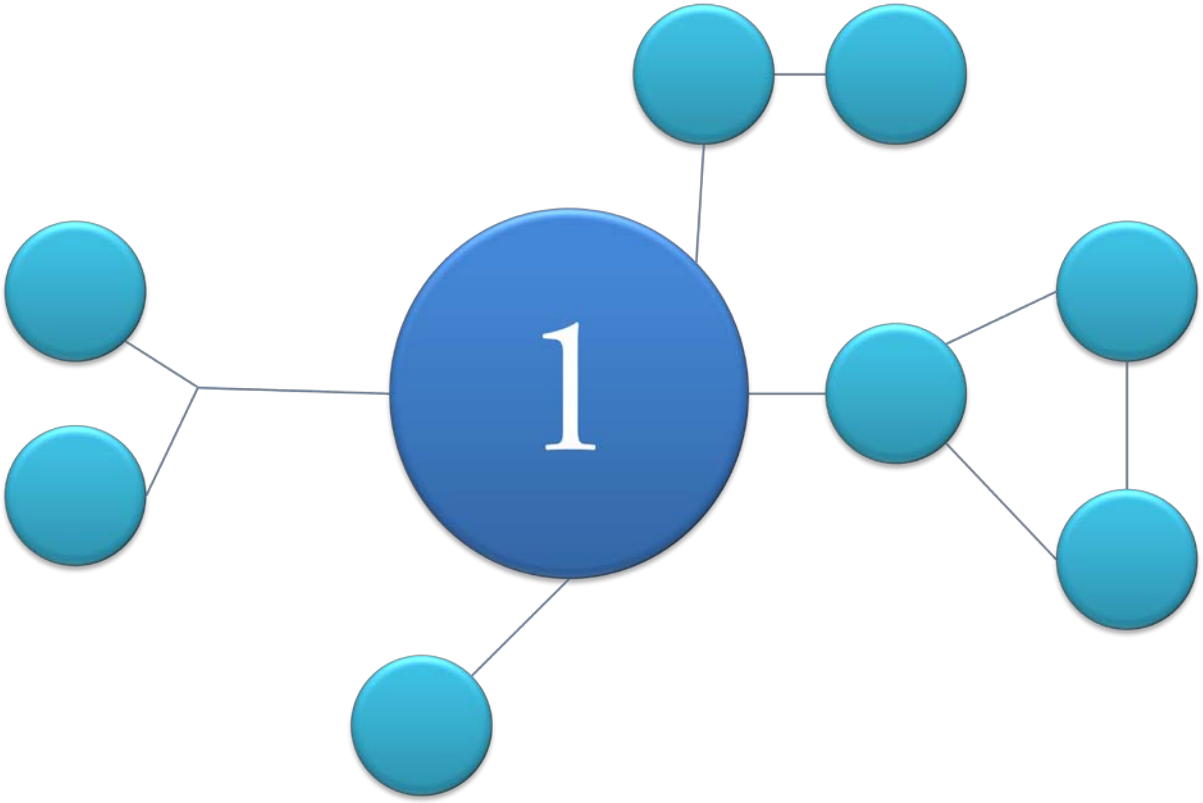
SKANSKA

Skanska is one of the world's ten largest companies within construction, residential development, commercial property development and infrastructure development. Skanska is involved in all aspects of the construction, from financing through design and construction to facilities management, operation and maintenance. The company has 52 000 employees in the home markets Europe, US and Latin America. Sweden is the second largest market standing for 23 percent of the revenue of SEK 122 billion in 2010. Skanska Sweden is divided into 21 regions, 110 districts, annually operates 3000 projects and employs 10 000 people. Skanska creates sustainable solutions and aim to be a leader in quality, green construction, work safety and business ethics. These values are expressed in five zeroes: Zero loss-making projects, Zero environmental incidents, Zero work site accidents, Zero ethical breaches and Zero defects.

VOLVO POWERTRAIN

Volvo Powertrain is a business unit within AB Volvo, one of the world's largest providers of transport solutions for commercial use. Volvo Powertrain has the main responsibility for the development and production of the powertrain, that is the engine, gearbox, and driven axles. The company supplies the business areas in the group, for example Volvo Trucks, Volvo Construction Equipment, and Volvo Buses, with its solutions.

Volvo Powertrain has approximately 9000 employees and deliver on a yearly basis 200 000 heavy duty engines, 125 000 transmissions, and 45 000 marine drives. The core values of the company are shared with the Volvo Group and contain three different areas; quality, safety and environmental care



CHAPTER 1

SUPPLY BASE STRATEGIES

Chapter 1 provides necessary concepts and background to the topic of supply base structuring. It starts with a brief introduction of the supply chain network and the challenges related to the concepts variety, complexity and heterogeneity. The chapter continues with describing supply base management. Furthermore, it introduces key concepts regarding purchasing and supply base structuring such as single and multiple sourcing together with several variants of these strategies. The chapter also addresses the current trend of reducing the supplier base and also the different kinds of relationships suppliers and buyers have. Finally it is described how these relationships change over time and how to manage supply performance. The chapter concludes by describing network sourcing.

THE SUPPLY CHAIN NETWORK

No company can alone produce its products from raw material to finished product, it is dependent on a network of relationships to other companies where material and/or services are traded (Skjøtt-Larsen, Schary, Mikkola, & Kotzab, 2007). Generally one puts the focus on a focal company that is dependent on a number of suppliers for the input to its product or service as well as distributors making the product available to the end customer (ibid.). Due to increasing focus on core competencies and outsourcing, these networks have become more and more complex. It incorporates an increased number of actors going from initial suppliers to the end customer, across the supply chain (Gadde et al., 2010). However, a simplified design of the linkages and actors in a supply chain network can be described as in Figure 2, where the focal company is surrounded by suppliers and customers (Lambert & Cooper, 2000).

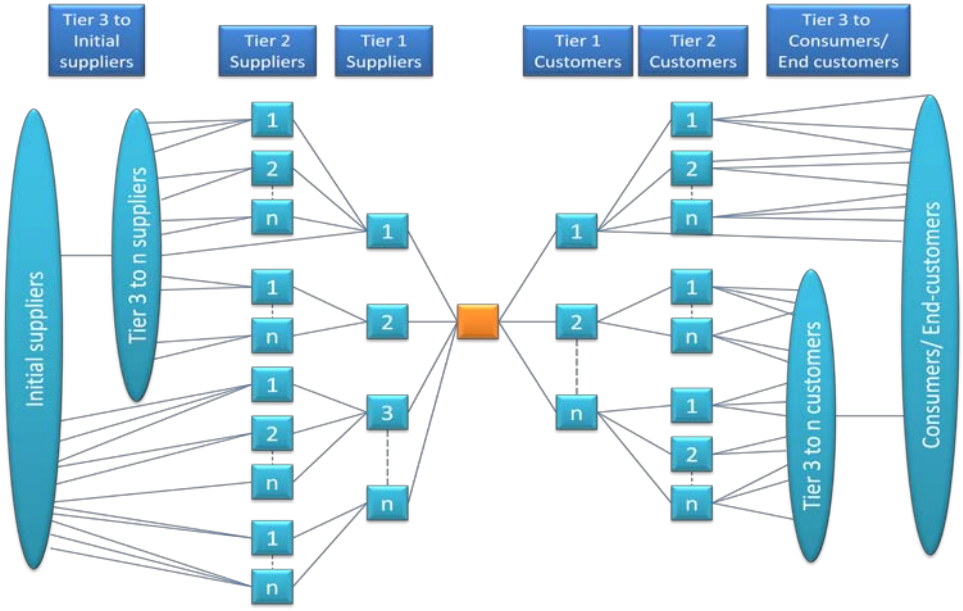


Figure 2. Supply Chain Network Structure adapted from Lambert and Cooper (2000)

On the supply side the focal company is linked to tier 1, tier 2 to tier *n* suppliers and the same on the demand side with tier 1, 2 to *n* customers. In Figure 2 adapted from Lambert and Cooper (2000) it can be interpreted that tier 1 suppliers are those that have a direct link with the focal company while tier 2 suppliers have links to tier 1 suppliers. Tier 2 suppliers are thus subcontractors to the focal company. However, Cousins (1999) define tier 1 suppliers as "those that integrate systems for direct supply to the assembler, or have a significant technical influence on the assembler while supplying indirectly". Tier 2 suppliers are "those that supply components to the first tier firms for integration into systems, or provide some support service" (ibid.). This definition, contrary to what the picture indicates, states that a direct link to the buying company from the tier 1 supplier is not necessary as long as the influence is significant, for example this transaction can go through a wholesaler.

Lambert and Cooper (2000) present three dimensions to describe the structure of a supply network:

- Horizontal structure
- Vertical structure
- Horizontal position of the focal company.

The horizontal structure refers to the number of tiers across the supply chain. Looking at Figure 2 this means how many tiers there are, including the initial supplier. The vertical structure refers to the number of suppliers represented within each tier. Again looking at Figure 2 this means how many suppliers there are within for example tier 1, as this is a general picture the number here is 1 to *n* suppliers. Last the horizontal position of the focal company denotes where in the supply network the focal company is positioned. Changing the network structure of the focal company, for example narrowing the vertical structure, could be done by moving from multiple to single sourcing. Outsourcing activities may increase both the length and width of the supply chain as more suppliers get involved. (Lambert & Cooper, 2000)

For each company, the specific constellation of the supply network represents a unique set of resources and geographical spread (Gadde et al., 2010). So far it has been described on a general level how a supply network structure can be organized. Deciding on the specific design for a certain company and how it shall be managed is what supply chain management is about. According to (Lambert & Cooper, 2000) supply chain management can be divided into three connected component categories: Supply chain network structure, supply chain business processes and supply chain management components, see Figure 3.

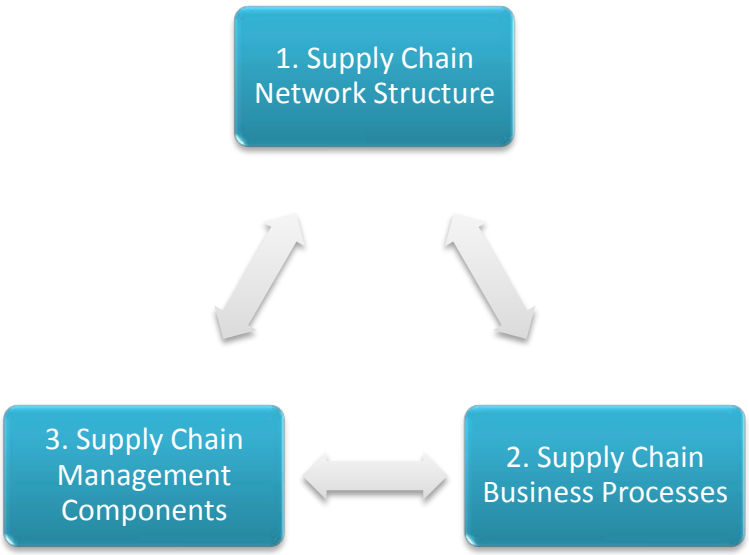


Figure 3. Supply Chain Management framework adapted from Lambert and Cooper (2000)

- *Supply chain network structure* includes the process of identifying which key supply chain members with whom to link processes (Lambert & Cooper, 2000). Different types of relationships are required since high collaboration with all members would be too complex and demand too much resource (Skjøtt-Larsen, Schary, Mikkola, & Kotzab, 2007). The supply network hence involves different types of relationships.
- *Supply chain business processes* is the next step, to identify which processes to link with each of these key supply chain members (Lambert & Cooper, 2000). These links includes resources, activities and actors (Skjøtt-Larsen, Schary, Mikkola, & Kotzab, 2007).
- *Supply chain management components* is where you finally decide upon the level of integration and management that should be applied for each process link (Lambert & Cooper, 2000). Several portfolio matrices have been developed to facilitate this decision (Gadde et al., 2010); these are further described in Chapter 2.

One confusing aspect in the Supply Chain Network introduced by Lambert and Cooper (2000) is their definition of horizontal and vertical structure. The definition is connected to their illustration, Figure 2. However, the vertical and horizontal integration is often defined in the opposite way. Later in Chapter 4 the general definition is used, and not the one Lambert and Cooper (2000) have chosen.

SUPPLY BASE MANAGEMENT

The supply base of a company can be defined as all the suppliers taken together (Gadde et al., 2010). Another definition provided by Skjøtt-Larsen et. al (2007) is that the supply base is the collection of all suppliers the buyer is involved in doing business with. A more precise definition is emphasized by Choi and Krause (2006), "A focal firm's supply base is defined as only those suppliers that are actively managed through contracts and the purchase of parts, materials and services". The supply base does hence not only incorporate tier 1suppliers but also tier 2, 3 and so on (Choi & Krause, 2006). An important distinction is that while a supply network includes all the companies that directly or indirectly takes part in supplying the focal company, the supply base does not (Choi, Dooley, & Rungtusanatham, 2001). The definition of the supply base used from now on in this book will be that "the supply base is the collection of suppliers the buying company is doing business with, from tier 1 to tier *n*".

The focus on purchasing and the supply base has become increasingly important (Pedersen & Holmen, 2007; Gadde & Snehota, 2000; Gadde et al., 2010). For example the purchasing cost at the beginning of 2000 in the whole industry sector in the US was 50 percent, and in some sectors up to 70-80 percent (Gadde et al., 2010). According to van Weele (2009) the purchasing cost for manufacturing companies are 50 percent in relation to the cost of goods sold. Adding indirect business cost to this the total amount would be roughly 68 percent (van Weele, 2009). These varying numbers indicates that there is a span of how much is outsourced ranging between 50 percent up to 80 percent.

Importance of purchasing at Mölnlycke Health Care, Skanska and Volvo Powertrain

The Surgical division at Mölnlycke Health Care started to reduce the supplier base in 2008. This was done both in order to reduce the total amount of suppliers and to reduce the amount of suppliers which were located far away from the company's production sites. By eliminating suppliers located far away lead times shortened and uncertainty caused by transportation time decreased. Today Mölnlycke Health Care has stopped focusing on reducing the amount of suppliers and instead has a goal of having a stable amount of approximately 170 suppliers.

Since 2009 Skanska Nordic, including the countries Sweden, Norway, and Finland, has an appointed central purchasing unit, *Nordic Procurement Unit (NPU)*, with 230 employees. The goal of this unit is to make Skanska Nordic more competitive. Therefore NPU supports project with project purchasing by specialists and international agreements, framework agreements with cost efficient, green and safe suppliers and last logistic infrastructure with innovative logistics solutions. Because of the fragmented supply market and the geographical spread of the 3000 annual project purchasing has traditionally been decentralized, by each project. But since 70 percent on average of a project's cost is purchased services and material an enormous potential has been realized by making purchasing more strategically. Today one third of the purchased services and materials are made through NPU, with a long-term goal of reaching two thirds.

By Volvo AB having acquired Renault along with Mack Trucks in 2001 and later on UD Trucks in 2007, Volvo Powertrain's supply base consisted of over 1000 suppliers. By sourcing more strategically since 2001, for example going from transactional purchases and annual negotiations to coordinated and cross-functional purchases as well as developing common platforms for the powertrain, Volvo Powertrain has been able to reduce its supplier base to approximately 100 suppliers. Strategic sourcing is of importance to Volvo Powertrain since the cost of purchased material stands for 75-80 percent of the cost of the finished product.

As seen from the case descriptions the supplier base is one of the most important strategic issues in the companies and how it is managed influence their performance to a large extent. For Skanska and Volvo Powertrain the purchasing cost stands for a large part of the finished product's cost, which further emphasizes this. The companies have reached different levels of their strategic sourcing maturity, where Volvo Powertrain has come furthest and Skanska has only started a couple of years ago. However, this is because of its very differing market challenges; as mentioned Skanska has 3000 projects annually at different locations. Comparing this with a manufacturing company with perhaps two or three production locations, one realizes that companies faces different challenges in managing their supply base. Three general challenges related to variety, complexity and heterogeneity are described by Gadde et al. (2010).

- *Variety*, the supply market includes a variety of goods and services, supplied by vendors that differ in many ways. For example some vendors are small and others large. Some are technically advanced while others are production oriented. Handling this variety will impact on the effectiveness and efficiency of the buying company (Gadde et al., 2010). This is also described by (Choi & Krause, 2006) as differentiation of suppliers in terms of organizational culture, location, size and technology.

Variety at Skanska

Skanska has a large variety in their supply base. The suppliers are spread over a large geographic area with suppliers all over the Nordic countries. For the material supply side, consolidation of the suppliers is common and has led to an increasing number of large global suppliers. For services on the other hand, many suppliers consist of only one or a few persons that supply locally. Since these suppliers make out approximately 60 percent of Skanska's supplier base, they form a large number of suppliers and make the handling and control of them costly. Concerning technical advancement, the difference between the suppliers is large including suppliers that offer products that range from steel and other raw materials to more high technological machines and products.

The large variety impacts on Skanska's efficiency, where a lot of administration is needed to handle this variety in the supplier base. Skanska's work in reducing the number of suppliers in its supply base can therefore be seen as a way for it to reduce the costly supply base variety. On the other hand it opens up for competition amongst the suppliers and keep the dependency levels generally low.

- *Complexity*, the buying company can either rely on a large number of component suppliers, a small number of sub-system suppliers or a single supplier of complete modules. These dimensions can be combined in various constellations with organization of relationships and coordinating among these. Identifying, formulating and coordinating this complexity are key challenges in designing the supplier base (Gadde et al., 2010). A high level of inter-relationships between the suppliers increases the supplier base complexity (Choi & Krause, 2006).

Complexity at Volvo Powertrain

Volvo Powertrain is currently producing the heavy duty diesel engines (HDE) in-house while outsourcing the production of the medium duty diesel engines (MDE). This strategy for the last years has helped Volvo Powertrain to reduce the complexity in its supply base to be able to spend its resources on the development of HDE. With the experiences gained from this successful development process, Volvo Powertrain is now considering bringing the production of the MDE in-house. This would keep its production and development closer to Volvo Powertrain's core competencies and synergies could be exploited. This would again increase the supply complexity.

What is important in Volvo Powertrain's case is that a company works with limited resources and has to work with this to find the best business opportunities. Also, increasing the complexity may reduce costs, which can be needed in certain situations, but it may also reduce the benefit opportunities which Volvo Powertrain is now looking to gain.

- *Heterogeneity*, the value of a resource depends on how it is combined with other resources. The buying company can change its own resources to better exploit the suppliers' or influence the supplier to modify their resources to better suit theirs'. How resources are assessed and exploited are a key to success (Gadde et al., 2010).

Heterogeneity at Mölnlycke Health Care - Wound Care division

The Wound Care division provides products which are characterized as innovative in their market. This leads to that the company is constantly looking for new products and materials to employ or to combine with existing products or materials that compose the present product portfolio. A showing example of the benefit of pooling competencies is the development of a new type of silicone in one of the company's coming products. Wound Care has through cooperation with a silicone supplier developed a silicone with unique properties. By combining the new silicone with an existing product the company will gain a significant competitive advantage.

The successful combination of resources at Mölnlycke Health Care's Wound Care division, provides one example of how a combination of resources can greatly increase its value more than the sum of them individually.

The supply base structure will influence how well a company will manage and take advantage of the opportunities these challenges pose. The most important issues in managing the supply base were identified in a literature review by Pedersen and Holmen (2007) to be: The numbers of suppliers in the supply base, reducing the number of suppliers in the base, management of supply performance, how suppliers are organized, the nature of the relationships between the buyer and the suppliers and, how buyer-supplier relationships can change over time. These issues are illustrated in Figure 4 below.

Figure 4. Supply Base Management adapted from Pedersen and Holmen (2007)

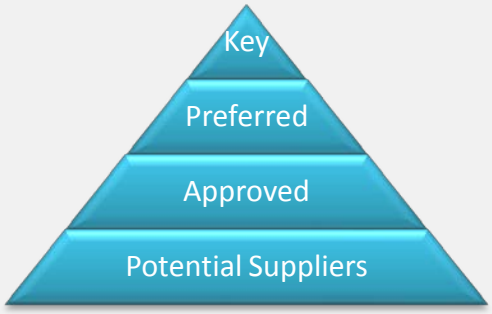
Further Skjøtt-Larsen (2007) and Gadde and Håkansson (1994) argues that there are two strategic issues involved in the supply base structure; the number of suppliers and organization of suppliers. However, parallels between organization of suppliers and how suppliers are organized and the nature of the relationships between the buyer and the supplier in the two different definitions can be drawn.

Linkages could be drawn from the framework of supply base management by Pedersen and Holmen (2007) to supply chain management provided by Lambert and Cooper (2000). It can be argued that the *Supply chain network structure* includes choosing the number of suppliers to co-operate with and highlights that different types of relationships are needed with different suppliers. The *Supply chain business processes* could include which activities and resources should be linked to which supplier i.e. organizing and initiating the relationship between the buyer and supplier. The *Supply chain management components* is where you decide upon the level of integration and management of the resources and activities for each supplier. Several portfolio matrices have been developed to facilitate this decision (Gadde et al., 2010); these are further described in Chapter 2. Management could include both evaluating supplier performance, how relationships can change over time and the reduction of the number of suppliers.

As the framework provided by Pedersen and Holmen (2007) seems to provide a holistic view of supply base management, by capturing the importance of supply chain management and incorporating the definition by Skjøtt-Larsen et al. (2007), it is used to give light to the important issues in managing the supplier base. Further, supply base issues prominent at Skanska are given by the example below.

Supply base management - Supplier classification at Skanska

As a result of the increased focus on strategic purchasing Skanska has divided the suppliers into four overall categories: Potential suppliers, approved suppliers, preferred suppliers and key suppliers. This classification pyramid is presented below.



This classification of suppliers has not been done before. Therefore Skanska is now working itself from the bottom, with unclassified suppliers, to the top of the classification pyramid. This process can be summarized in three steps with a pre-qualification round, to secure that all suppliers in the supply base lives up to Skanska's basic requirements. Then the on-site performance evaluation will further help to consolidate the supply base. The last step in the process is to segment the suppliers and develop and work more long-term with prioritized suppliers.

Skanska has recently launched a preferred supplier program. The purpose of the program is described below and will help guide supplier selection in reducing the supplier base.

- The starting point of the program is *reduction of risks* to ensure that Skanska is only working with legal and financially stable suppliers. Active control of the suppliers will facilitate this.
- Secondly suppliers are to be rated based on their performance and not only price and treated differently depending on the results. This will give the *suppliers incentives to perform better*. Examples of evaluation criteria are:
  - Delivery precision
  - Customer satisfaction
  - Quality deviations
- *Consolidating the supplier base* is the third issue. This will be done by expanding work with well performing suppliers and reducing the work with those that are not performing well.
- Last Skanska will develop long-term relationships with *preferred suppliers* that have high strategic importance and good performance and support them through supplier relationship management.

In the future Skanska also wants to classify some of the high performing preferred suppliers with most strategic importance as key suppliers that will be even more supported through supplier relationship management.

The issues described in the example from Skanska touches upon the issues described in the framework by Pedersen and Holmen (2007). First Skanska is considering the number of suppliers and how they should reduce them. Aiding in the process is performance evaluation and to further develop the relationships with a number of suppliers, supplier relationship management is used. Now that the example

has provided a short introduction to some of the issues, the rest of the chapter will be dedicated to describing each issue in the supply base management framework.

Number of suppliers

The first strategic issue within supply base management is the total number of suppliers in the supply base (Pedersen & Holmen, 2007). As a first step in this strategic process most companies divide their procurement into commodity groups or categories (Gadde et al., 2010). When a group of products are standardized they are called commodity parts (van Weele, 2009). The mixture of goods and services that a company buys from a supplier is called commodity groups. These groups are often classified in terms of the technical specificity of the products or their function in the end product (Gadde et al., 2010). After defining the categories, different sourcing strategies can be formulated, deciding the number of suppliers for each or more specifically; according to van Weele (2009):

- For which commodities should the number of suppliers be reduced?
- For which commodities should the number of suppliers be maintained?
- For which commodities should the number of suppliers be increased?

These are hence the main issues regarding the number of suppliers, and the answer depends on the variety, complexity and heterogeneity connected to the commodities context.

Sourcing strategies per category

As mentioned the supply base is a strategic asset to the buying firm. But the sourcing strategy also set the boundaries for the operational material procurement processes in the company and hence, the sourcing strategy is both a strategic and tactic issue (Jonsson & Mattsson, 2005). To handle the procurement in a company, different sourcing strategies should be examined and weighed against each other to find the most suitable strategy in the company context. The choice stands between applying a single sourcing strategy or a multiple sourcing strategy (Gadde et al., 2010).

Single sourcing

The single sourcing strategy implies that the company is supplied from a single source for a determined period of time. The supply has a medium to high level of asset specificity, since the goods and services often are directly linked to the buying firm's core competencies. An asset is specific when it is related uniquely to a specific transaction, and when it is less valuable in other transactions (Skjøtt-Larsen et al., 2007). But there are exceptions where the goods and services are not directly linked to the firm's core competence. In a highly technological company for example, it is not uncommon to use a single source for the staff food commissary. This business is not close to the company's core competence, and yet they use a single sourcing strategy in order to facilitate the handling of the supplier.

The advantages of single sourcing are higher quality and lower total costs as well as a link to higher cooperation between buyer and supplier (Berger & Zeng, 2006). Single sourcing involves more permanent ties and the development of closer cooperative relationships (Skjøtt-Larsen et al., 2007). But again, there are exceptions to this rule. Customers can choose to buy a product from several suppliers when the product is important to them, in order to secure the quality and access. When a product is of less importance the customer might choose to buy from a single supplier instead, in order to purchase the product or service in a simple manner.

Multiple sourcing

Multiple sourcing involves two or more suppliers (Skjøtt-Larsen et al., 2007). Multiple sourcing is traditionally dealing with suppliers at arm's length distance through market transactions. Within multiple sourcing strategies there are two variants, parallel sourcing and dual sourcing, see Table 1 (ibid.). The reason for using a multiple supplier strategy is to encourage competition between the suppliers in order to lower the price of the good or service. This strategy can make it difficult to engage in a close cooperation relationship in order to foster innovations and product development, since the element of competition is always available and to some extent undermine the possibilities for trust (Jonsson & Mattsson, 2005). Using a multiple sourcing strategy is also a way to mitigate the risks of only having one supplier as well as to avoid dependence (Gadde et al., 2010). Skjøtt-Larsen et al. (2007) present a comparison of the advantages and disadvantages of single and multiple sourcing:

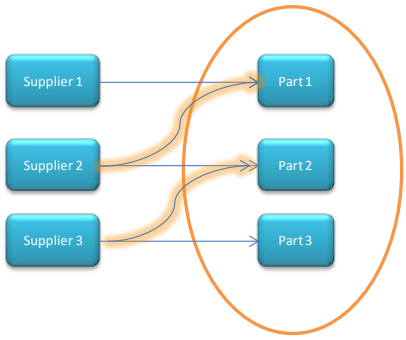
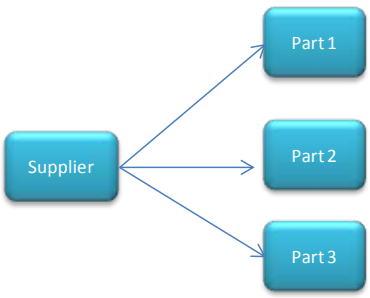
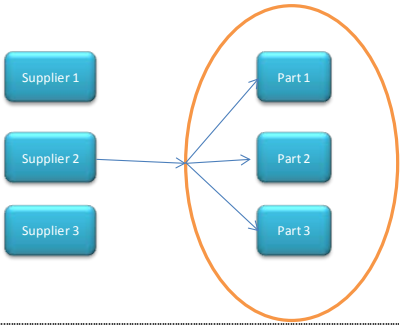
Table 1. The advantages and disadvantages of single and multiple sourcing adapted from Skjøtt-Larsen et al. (2007)

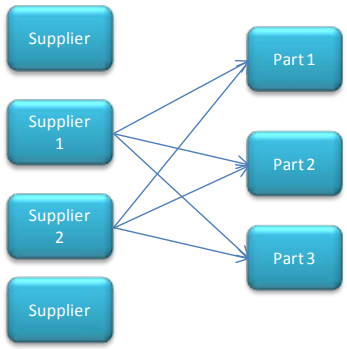
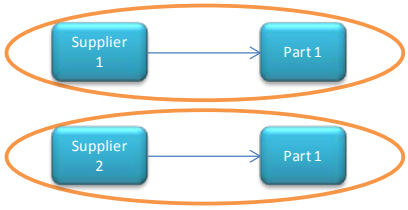
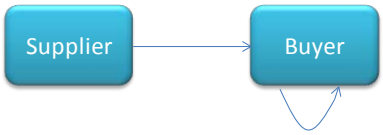
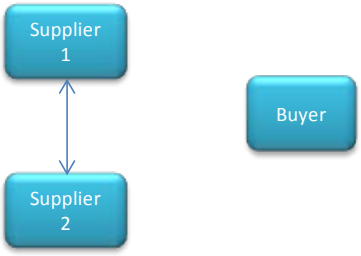
	Single sourcing	Multiple sourcing
Advantages	-Potentially better quality because more supplier quality assurance (SQA) possibilities -Stronger relationships which are more durable -Greater dependency encourages more commitment and effort -Better communication -Easier to cooperate on new product/service development -More scale economies -Higher confidentiality	-Purchaser can drive price down by competitive tendering -Can switch sources in case of supply failure -Wide sources of knowledge and expertise to tap
Disadvantages	-More vulnerable to disruption if a failure to supply occurs -Individual supplier more affected by volume fluctuations -Supplier might exert upward pressure on prices if no alternative supplier is available	-Difficult to encourage commitment by supplier -Less easy to develop effective SQA -More effort needed to communicate -Suppliers less likely to invest in new processes -More difficult to obtain scale economies

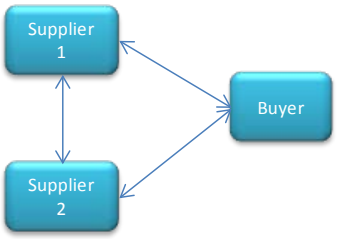
Variants of single and multiple sourcing strategies

There are other aspects in the supply strategy choice that present difficulties in choosing a pure single or multiple strategy. When looking at the variety, complexity and heterogeneity in the supply base, a pure single or multiple source strategy might not be sufficient to handle these issues. Therefore there are hybrids to the two strategies to handle the variety, complexity and heterogeneity issues in the supply base. Some important variants are presented below in Table 2.

Table 2. Variants of multiple and single sourcing strategies and their implications

Variants	Description	Implication	Illustration
Hybrid sourcing	This strategy is a mix of single and multiple sourcing. Multiple sourcing is used for a group of parts, but single sourcing is used for the individual parts in the group. This means that each part has one supplier, but the suppliers can deliver some of the other parts in the group as well if necessary (Jonsson & Mattsson, 2005).	The benefit is that if one supplier runs into delivery problems, another supplier can take over the deliveries for the time being. One drawback compared to single sourcing is less predictability of demand since several suppliers are used.	
Sole sourcing	This is a hybrid of single sourcing. One supplier is used since there is only one supplier available at the market (Jonsson & Mattsson, 2005).	The dependency increases since the buyer becomes heavily dependent on the supplier. In order to hedge against the risk of limited access to the suppliers goods or services or a too high price a close relationship could be established.	
Single group sourcing	One supplier is used for an entire group of products (Skjøtt-Larsen, Schary, Mikkola, & Kotzab, 2007).	This strategy brings lower handling costs but more dependencies than single sourcing. Again, a close relationship can be used to hedge against the risks of access and too high prices.	

Dual sourcing	Two suppliers are used for the same component, even though there might be other suppliers available on the market (van Weele, 2009).	This strategy enables more competition between the two suppliers, less dependency and less risk than single sourcing, but poorer conditions for partnership and product development.	
Parallel sourcing	When using parallel sourcing the same component are supplied to one plant from one supplier and another plant from another supplier, but used to build the same product. This strategy combines asset specificity together with long-term relationships of single-source character (Skjøtt-Larsen, Schary, Mikkola, & Kotzab, 2007).	The down side of loss of competitive power over the supplier in a single sourcing strategy is avoided and competition for future contracts is allowed for. This strategy can be used when a company has two plants producing the same products, but with a large geographic distance between the plants.	
Concurrent sourcing	The buyer both makes and buys the same goods, mixture of multiple and dual sourcing as it combines internal and external sources of supply (Mols, 2010).	Minimize transaction and production cost, access to information and problem solving, increased availability, operation at optimal scale and scope and, complementary source.	
Dyadic sourcing	Dyadic sourcing is described as a link in the supply chain. It could be a link between a sourcing and a buying unit or between two sourcing units (Wu, 2005).	This example shows a supplier-supplier dyad. The focal firm does not necessarily know that the suppliers are cooperating, since the cooperation does not have to be connected to the focal firm.	

Triadic sourcing	This strategy involves one buyer and two suppliers. There is a direct connection between the two suppliers as well as between the buyer and each one of the suppliers (Dubois & Fredriksson, 2008).	Using triadic sourcing, the buying firm can both nurture the cooperation and the competition between the two suppliers.	

Reducing the number of suppliers in the base

Since the late 80's or early 90's companies have actively reduced their supplier base. This could be seen as a reduction of both complexity and variety in the suppler base since fewer relationships have to be managed. But the complexity can also be increased by having close relationships with a large interface between the buyer and the supplier. The focus being a reduction of administrative and transaction costs as well as cost savings rendered by purchasing greater volumes from fewer suppliers. Accordingly many companies now favor single or dual sourcing strategies over multiple sourcing (Choi & Krause, 2006).

Besides active reduction by the buying company, the supply base has also been reduced through external actions such as mergers and acquisitions of suppliers have consolidated the supplier market. This has increased over the recent years. Therefore this development has also speeded up the supply base reduction (Christopher, 2011). Through the supply base reduction, the suppliers often become larger than the buying company. This has implications on the power relationship between the buying firm and the supplier, where the buying firm often looses power over the supplier.

In the pursuit of supplier base reduction Cousins (1999) have found that companies seem to follow this strategy without thoroughly consider the market dynamics and the cost and benefits involved. Too little time is for example spent on finding the optimal supplier and companies are uncertain of how they need to develop their relationships with the remaining suppliers. To pursue successful supplier base reduction the correct relationship method, strategic focus and performance measures must be in place. One important aspect is to assess the suppliers' capabilities and give incentives to them as it will affect them as well.

Further, according to Christopher (2010), there is a need for supply base rationalization in order to obtain agility in the supply chain. But there are risks connected to using a smaller number of suppliers. It can be dangerous to have a too high dependency level on a few critical suppliers. Issues relate for example to supplier capacity and capability e.g. product development (Choi & Krause, 2006). Christopher (2010) instead proposes to have a lead supplier for a category of products that takes responsibility for the management of that category of products across a number of suppliers. With a smaller supply base, Christopher (2010) claims that the supplier relationships can be more proactively managed through "supplier development" programs. These programs aim at improving product and process quality as well as resulting in joint cost-reduction initiatives.

Reduction of supplier base at Skanska and Mölnlycke Health Care

As mentioned earlier Skanska is currently working with reducing its supplier base. Today Skanska uses approximately 50 000 suppliers and with a few exceptions a multiple sourcing strategy. Many of the suppliers consist of one or a few employees. The reason for the large number of suppliers is that they work in projects, where each is unique both in required materials and services but also regarding geographical location. This makes reducing the supplier base a complex endeavor.

However one example of where Skanska has managed to go from 1800 suppliers to 100 is with haulers, a market typically characterized by one-man companies. Here Skanska told them that from now on we are only going to work with a few companies and set up framework agreements with them. A consolidation of the one-man companies followed. This was also seen as something positive from the haulers perspective as well with increased volume, less contacts etcetera.

The Surgical division at Mölnlycke Health Care has been actively engaged in supplier reduction, with supplier reduction as a key performance indicator (KPI) that is reviewed on a yearly basis. However the Wound Care division has not been embraced in such an effort, which is explained by the fact that the division operates at higher margin than the Surgical division. This makes efforts to invest in new products more worth than efforts to reduce the supplier base.

Hence, in reducing the number of suppliers it is important to not only focus on the own company but also on how these changes will affect the supplier and what it thinks about the change. In Skanska's case the change was mutually beneficial, which contributed to making the reduction successful. Also it must be emphasized that reduction of suppliers is something that can be done overall for the whole company or only for a certain division within the company. With that said a reduction of suppliers is not a strategy that all companies or divisions within a company are pursuing, as the Wound Care division at Mölnlycke Health Care.

The nature of the relationship between the buyer and the supplier

After the discussion regarding which number of suppliers to use for the procurement of a good or service in the sections above, the organization part of supply base management will now be handled. As described earlier developing appropriate relationships is one strategic issue within supply base management (Pedersen & Holmen, 2007) and thus purchasing in general (Gadde et al., 2010). Depending on the variety, complexity and heterogeneity described earlier in this chapter companies will develop different relationships with suppliers. Some will be closely integrated, others kept at arm's length, others will include joint product development and others will just depend on the specifications provided by the buyer. Just-in-time (JIT) requires close collaboration but in other cases inventories can be used to decouple the ties between companies (Gadde et al., 2010).

Buying companies can have a variety of relationship types with their suppliers. The relationship will vary in terms of extent of involvement, the continuity of the relationship and the sourcing strategy of the buying firm and this will have economic consequences (Gadde et al., 2010). It is further emphasized by (Gadde & Snehota, 2000) that the extent of involvement will depend on the economic importance of the supplier since a buying company only can be highly involved with a limited number or suppliers, due to

relationship costs. However developing deeper co-operation with a selected number of suppliers is necessary in global supply base management (Gadde et al., 2010).

The decision of involvement and continuity is directly linked to the relationship costs which can be summarized in direct procurement cost, direct transaction cost, relationship handling cost and supply handling cost and benefits which can be divided into cost benefits and revenue benefits (Gadde & Snehota, 2000).

Cost benefits that can come from avoiding being dependent on individual suppliers, which often means high involvement, is reduced transaction uncertainty, enhanced technological flexibility from not being locked to a certain supplier and opportunities for price pressure (Gadde et al., 2010). The result from this is relationships at an arm's length. However, while increasing the ability to negotiate procurement price, it will not necessary reduce the transaction cost since call-offs are made on a regular basis (ibid.). In the absence of cooperation, buffers might be installed to deal with potential delivery problems and many suppliers might be used to secure availability which increased the supply handling cost. High involvement relationships may lead to reduced cost in production processes and physical flows as well as improved service level and flexibility which in turn lead to improved quality and revenue benefits for the buying company. However higher involvement relationships increases relationship handling costs. Reaping these benefits requires non-standardized solutions and relationship-specific adoptions (ibid.).

Relationship regularity refers to the longevity of the supplier-buyer relationship. In high involvement relationships adoptions to each other often occur which are time and resource consuming and therefore these are often more long-lasting than low involvement relationships (Gadde et al., 2010).

How suppliers are organized

The supplier base can be organized internally or externally (Gadde et al., 2010). The internal organizing could refer to how the purchasing department is organized in terms of who handles the contact with each supplier and on what level, or how the product development department relates to the supplier. The external organizing could refer to how the suppliers are differentiated or how close they are kept to the buying company. But Gadde et al. (2010) claim that the most important issue is that the internal and external organization must be coupled for a supply base to be successful. This should be done by the purchasing department, which would then function as an interface between the internal functions of the buying company and the external supplier and their functions. This coupling done by the purchasing department then includes connecting actors and resources in order to create value for the buying company but also for the supplier. Several actors could be connected between the buyer and the supplier, thus enabling for a broad interface. This could be beneficial in order to foster creativity and innovations between the firms. The downside is that having a broad interface could be difficult to manage and also expensive, so there is a need for a trade-off between the need for creativity and innovations and the costs for managing the relationships. Another aspect of the purchasing department when functioning as the interface between the buyer and the supplier is that the coupling of resources enables for exploiting the heterogeneity of the supplier. Gadde et al. (2010) claim that when organizing the supply base, the main reason is to exploit the heterogeneity of suppliers' resources. It is required to have a high-involvement relationship with the supplier in order to take part of the benefits of combining resources. As mentioned previously in this chapter, heterogeneity means that the value of a resource depends on how it is combined with other resources. This mean that the purchasing department, simply by combining the buying firm's resources with the suppliers resources, could increase the value of the buying firms resources.

Gadde et al. (2010) present some central issues when it comes to exploitation of heterogeneity. The opportunities to benefit from heterogeneity come from how the following issues are handled:

- What is the nature of the knowledge that is of importance?
- Where should this knowledge be located?
- What does the buyer and supplier need to know about each other?

The handling of these issues also connects to the variety in the supply base. If the company is good at exploiting the heterogeneity the variety is also greater. When the company then accesses the specific resources at a supplier with a close relationship, the relationship becomes unique. In order to handle the relationship differently, adaptations in the buying organization is required. This concern the teams that the buyer and the supplier choose to involve in the relationship.

The complexity is then connected both to the single relationships between buyer and supplier but also in the connections between them (Gadde et al., 2010). There are ways to handle the complexity, for example in single relationships teams can be formed and routines can also help facilitate the handling of the relationship, but for the connections between the link between buyer and supplier integrating activities by groups specialized in these issues could be helpful (ibid.). As previously mentioned, identifying, formulating and coordinating the complexity are key challenges in designing the supplier base (ibid.).

How relationships change over time

When deciding how to source a product, two of the major issues are how many suppliers to use and how to organize those (Skjøtt-Larsen et al., 2007; Gadde & Håkansson, 1994). When it comes to the organization of suppliers, the relationships that the buying firm establishes with them is a major issue. But relationships are not static; they can change over time. What can impact on the nature of a relationship between buyer and supplier, apart from the obvious human factors, is the maturity of the purchasing department as well as the demand for the product or service purchased which also changes over time. This fact impacts on the choice of sourcing strategy since what type of relationship is needed also depends on the purchasing departments maturity and demand for the product or service.

The *Technology adoption life* cycle is a model that describes how mature a person or organization is in pursuing new technologies. The model is described by a curve, which can be seen in Figure 5 below.

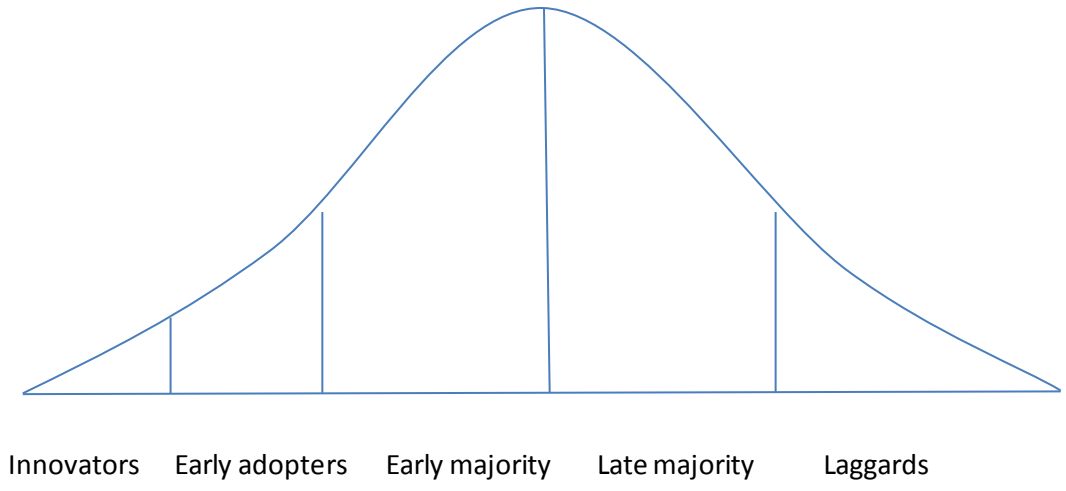


Figure 5. The Technology adoption life cycle (Moore, 2006)

The innovators are aggressive in their pursue of new technology. They actively seek new technology, and act as guarantees to other players in the market about a product's ability. The early adopters are not as early to buy into new concepts as innovators, but they find it easy to relate to new technology and use it in relation to other concerns in their life. The early adopters open up the market to the later segments of buyers. For the early majority it is the practicality that drives them to buy new technology and here often one third of all potential buyers can be found. Buyers belonging to late majority on the other hand are not comfortable with new technology and want to buy from well established firms. Also here one third of the buyers can be found. In the end the laggards are found, which are generally not considered worth pursuing due to their unwillingness to try out new technology.

Parallels can be drawn to the purchasing department and its maturity. The purchasing department's maturity is described by Rozemeijer, van Weele and Weggerman (2003) as how professional the department is regarding the purchasing function. A purchasing department that is described as an innovator would work very closely with the product development department and constantly seek new solutions and functions that will contribute to the company's strategic goal. An early adopter would seek out new technology or functions but wait for the innovators at the market to try it out. But if the product or service purchased is a new innovation for example and the purchasing department is situated in the late majority; important innovations might be missed due to the late majority's hesitance to new technologies. A product can be seen to go through a similar life cycle at the market, as can be seen in Figure 6 below.

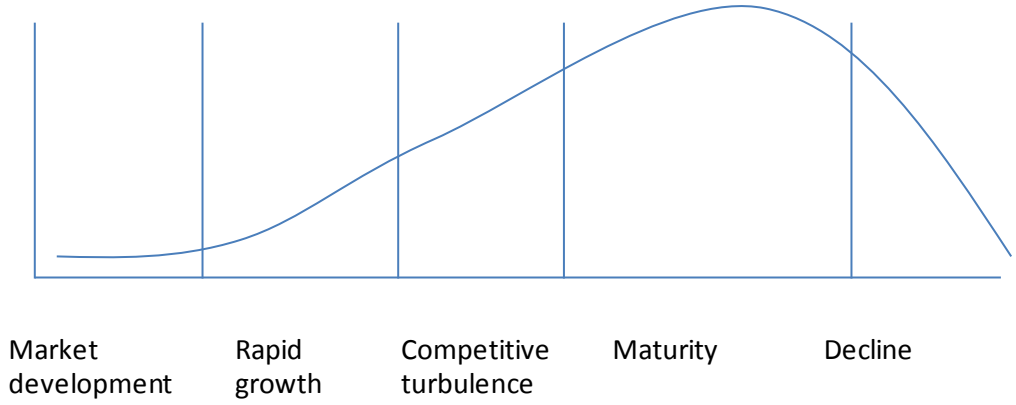


Figure 6. Product development lifecycle (Hofer, 1975)

Depending on whether the product is in the market development or maturity stage, the purchasing department should handle the product and its suppliers differently. During the market development to the competitive turbulence stage the interaction between the buyer and supplier is likely to be intensive and collaborative. Due to this fact, it is not uncommon that new innovations and functions are developed outside the intended goal. During the maturity stage the intensity is likely to decrease, and at the decline stage the relationship is likely to be less and less needed. But since often new innovations and functions are developed in the early stages of a products life cycle, a relationship rarely only lives over one products life cycle. Often the buyer and supplier have many products that overlap in their life cycles and hence the relationship is not dependent on the products but is rather connected to the knowledge and experience the buyer and supplier uses for product development. Hence it is a matter of the intensity of the relationship, which varies with the portfolio of products and where the products are situated in their development life cycle.

van Weele (2010) presents a Purchasing and development model where he describes the purchasing department of different industries by their maturity. The model can be seen below in Figure 7.

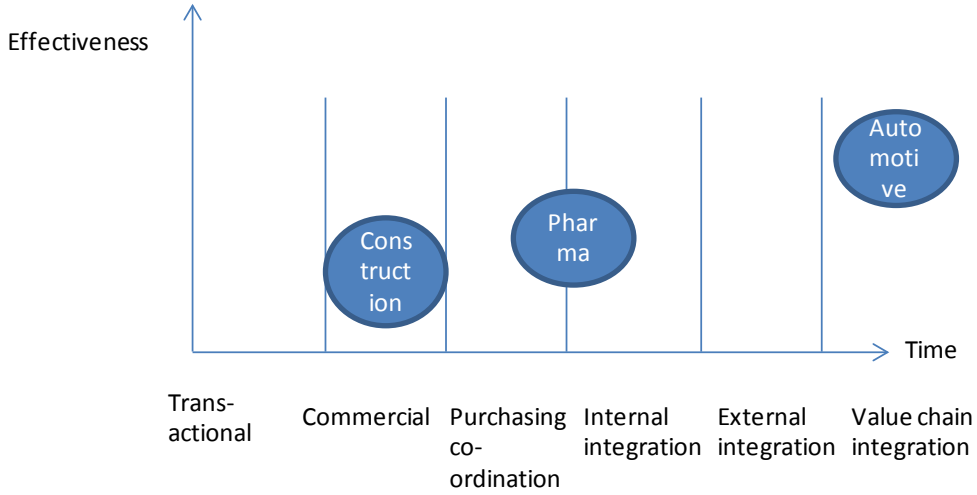


Figure 7. Purchasing and supply development model adapted by van Weele (2010)

This model makes it clear that different purchasing departments have different preconditions and challenges and therefore have different needs when it comes to relationships with the suppliers. For the construction industry for example it is important that the prices are low and therefore the need for a high involvement relationship is generally not necessary. But for the automotive industry the focus is on delivering value to the customer (van Weele, 2009) and this could imply a need for a high involvement relationship where product development is an important part of the exchange.

Management of supply performance

Assessing the performance of the supply base is also an important issue in managing the supply base (Pedersen & Holmen, 2007). This is also advocated by van Weele (2000) in order to gain better results from the supplier so that the agreed conditions and qualifications are lived up to. Earlier Skanska's supply base management process was described where evaluating the supplier performance was important in order to identify high performing suppliers that should become the "preferred and key suppliers" in the supplier classification process. Another company example of performance evaluation is given below.

Suppliers' perception of the relationship performance at Volvo Powertrain

Volvo Powertrain is continuously working with its suppliers to evaluate how the supplier perceives the dimensions of their relationship. For example smaller surveys have been done in the supply base. The dimensions that Volvo Powertrain would like to incorporate in future supplier evaluations are described in the method of working relation index (WRI) which incorporates five areas.

- Scale overall relationship, range: adversarial-partnership
- Communication, range: limited-open/honest
- Help/support (in meeting price and quality demands), range: poor-great
- Hindrance (to do best possible job), range: low-high
- Profitability opportunity, range: poor-great

The goal of using a survey incorporating these dimensions is to quantify the quality of its supplier working relations and thereby start a discussion on how to improve these areas. A high WRI is correlated to suppliers' willingness to share technology and to work towards jointly improving quality, cost and competitiveness. These are benefits Volvo Powertrain wishes to gain through its supplier relations.

This example emphasizes that performance evaluation goes two ways. In order to create a successful relationship with a supplier it is also important that the supplier is given the opportunity to evaluate the relationship.

This is something that is emphasized within the area of total quality management. Creating win-win relationships is important in order to become successful in the long run, rather than win-lose relationship where really every actor becomes a loser in the end. Feedback or performance evaluation will help improve and develop the relationship which will lead to higher quality, productivity and delivery punctuality.(Bergman & Klefsjö, 2010)

Network sourcing

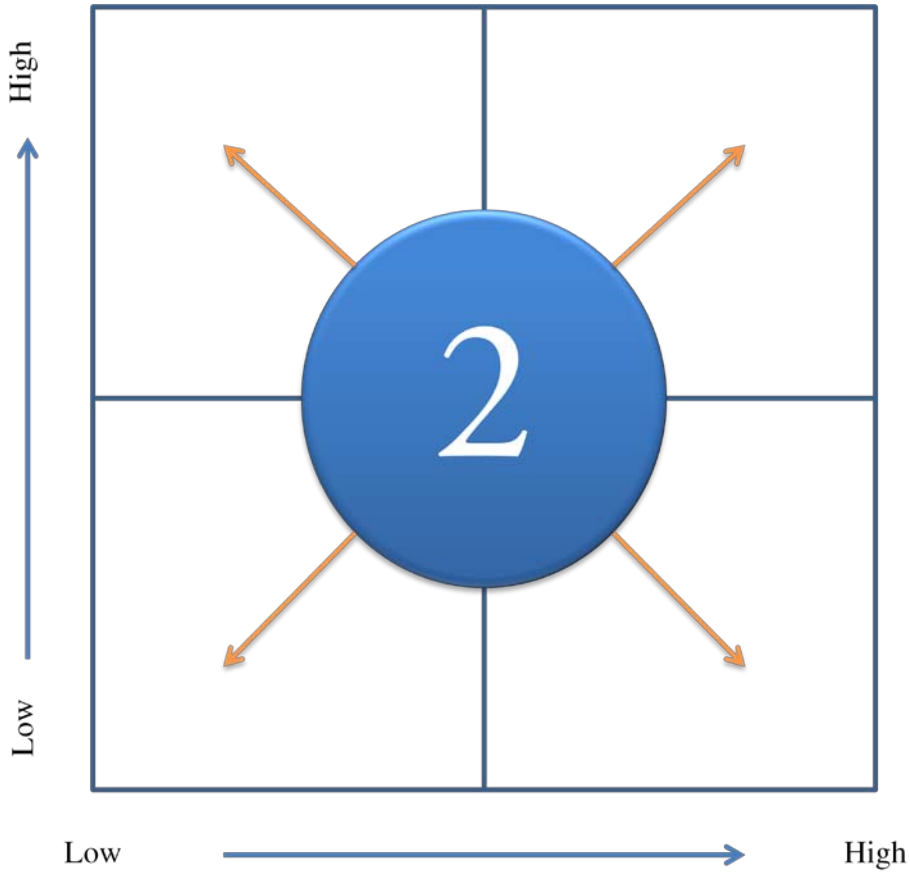
When the buyer and its suppliers are engaging in cooperation in many different aspects this is called network sourcing. Aspects that are included in the network sourcing are a tiered supply structure, risk sharing and relatively high asset specificity, sharing or exchange of staff between buyer and supplier, supplier involvement in both design and innovation early in the processes, relationships based on trust and supplier associations and supplier development and coordination (Skjøtt-Larsen et al., 2007). The most fundamental part of a supply network strategy is however the relationships with the suppliers (Gadde et al., 2010).

It could be important for the buying firm to be able to approve the lower tiers of suppliers and not just the direct suppliers to the company (Gadde et al., 2010). This is due to the fact that the risk of unexpected disruptions of the supply chain increases by an extended network (Christopher, 2011). Quality could be of importance if a company is also supplying spare parts to their customers (Gadde et al., 2010). If the spare parts are made by a lower tier supplier, it is still important that the buying firm can assure the quality level of those parts when they go on the market (ibid.). Another area of importance is if the buying firm is using a system supplier, with several deeper tiers. The lowest tiers can then be specialized and the tier 1 suppliers can have a close relationship with the buying firm (ibid.). This close relationship facilitates for developing new products together and also sharing components, since both buyer and supplier is more interdependent (ibid.).

Network handling at Skanska

For Skanska, it is important that their suppliers fulfill Skanska's requirements such as certain requirements on safety, code of conduct and environmental considerations. This does not only refer to their direct suppliers but also the lower tier suppliers, which is their entire supplier base. But it is difficult to control these lower tier suppliers since they are not in direct contact with Skanska. Therefore Skanska has pre-requirements on new suppliers early in the process, mainly in the central purchases, to reduce the risks of having a supplier that does not fulfill Skanska's demands.

For Skanska, supplier certification could be a solution to the example mentioned above. A certification would inform the suppliers of the requirements that are placed upon them in a concrete manner. This would help the supplier to conform to Skanska's requirements at the same time as Skanska can be more certain that the suppliers are fulfilling their demands. An important aspect to consider is to think of the requirements placed on the supplier. The requirements could function as a guideline when selecting suppliers, but with benefit be discussed with the supplier before they are set. This is because the demands placed on the supplier, however reasonable they may seem, could impact negatively on the supplier's activities. It could be a simple change in the buyer's process that could result in considerably higher costs in the supplier's process which would then be transferred down in the supply chain. Therefore a discussion about the requirements early in the supplier certification process could bring these requirements that could lead to a cost increase up to the surface and enable to avoid the unnecessary cost.



CHAPTER 2

PORTFOLIO MATRIX MODELS

This chapter aims at describing different matrix portfolio models. Its goal is not to be exhaustive on all matrix portfolios but instead aim to provide some general knowledge together with some key matrix portfolios. The chapter starts out with a brief history of matrix portfolios and then presents the Kraljic matrix which is probably the most well-known matrix portfolio model within purchasing. It goes in depth with the inputs, outputs and the axes of the matrix. Furthermore, it explains the four cells in the matrix and the four step process for usage of the matrix as presented by Kraljic. It also discusses the applicability of the Kraljic matrix. Together with the Kraljic matrix the chapter presents three more matrices by Olsen and Ellram (1997), Bensaou (1999) and Gelderman (2003). The chapter is summed up by a comparison between the different matrices and general applicability with matrix portfolios.

THE KRALJIC PURCHASING PORTFOLIO MATRIX

Peter Kraljic's approach was introduced in 1983 in the paper *Purchasing must become supply management*. The matrix Kraljic developed in his item has become the origin of several other purchasing models in the field (Gelderman & van Weele, 2005) and it is therefore a natural departure for a chapter focusing on portfolio matrix models.

The most famous context from Kraljic (1983) is the purchasing sophistication matrix, see Figure 8, and the general goals with this matrix are to exploit the position towards the suppliers in order to get as much benefits as possible. The supply dependency for a company is according to Kraljic based on two factors; the strategic importance of the purchase and the complexity of the supplier market. These two factors become the input to the model and are therefore also the dimensions of matrix's axes. Dependent on which kind of relation it is between the two dimensions, Kraljic categorize them into four different boxes; leverage items, strategic items, non-critical items, and bottleneck items. Both the content of the input dimensions and what kind of products the different categorize contain will be introduced later in this chapter.

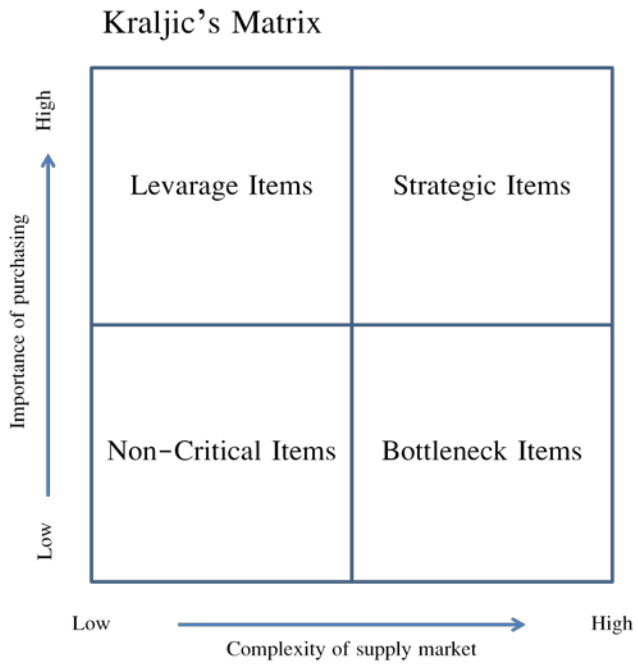


Figure 8. Kraljic's stages of purchasing sophistication (Kraljic, 1983)

In order to shape a supply strategy four different phases can be used; classification, market analysis, strategic positioning, and action plans (Kraljic, 1983). The matrix in Figure 8 is only used in the classification phase, however it is often this specific figure authors refer to when writing about the Kraljic portfolio method. The four steps will be described in another section of this chapter.

The origin of Kraljic's portfolio model

Kraljic is known by introducing purchasing portfolio models, but the portfolio models itself has its origin in the early 50's. Harry Markowitz is often known as the father of portfolio models. He came up with a model 1952 in order to help investors reduce their risk. Markowitz's model is known as the Mean-Variance model. According to Markowitz (1999) he finds the inspiration for the portfolio item in the

book *The Theory of Investment Value* written by Williams in 1938. Even if Markowitz himself does not feel comfortable to be labeled the father of portfolio models he is probably the most important individual for the development of these kinds of models. An example of Markowitz importance is that due to his pioneering work in financial theories 1990 he was awarded with *The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel* (Markowitz, 1999). The Portfolio models continued to develop during the 60's and 70's, especially by several different marketing models (Shaw & Goodrich, 2005). In 1977 George Day published the paper *Diagnosing the Product Portfolio* which explains the famous Boston Consulting Group marketing portfolio model (Day, 1977). In 1982 Renato Fiocca introduced a four square marketing portfolio matrix model with the axes *difficulty in the account* and *strategic importance of the account,* which seems to be very close to the Kraljic's input parameters, but in another environment (Fiocca, 1982). It is likely that Markowitz's and foremost the early marketing portfolio models have been an inspiration for Kraljic.

In the early 80's the supply and demand pattern had started to change, a previous stable situation started to become volatile. At the same time the purchasing cost share of a product's total cost started to increase. Some companies had already in this stage started to act in order to cope with the changes while others did not realize the importance of the changing environment. At this time Kraljic had a persuasion that enhanced attention to the purchasing function of a company was needed (Kraljic, 1983). Purchasing was treated more as transactional activities than strategic functions. Kraljic (ibid.) believed that a change towards strategic supply was needed. The portfolio model he developed had an objective to introduce a useful approach for when the purchasing function was treated as strategic. The basic idea was to minimize the supply risk and at the same time maximize the buying power (ibid.).

The Input to the matrix

As mentioned briefly in the description of the Kraljic purchasing model it has two input parameters. (1) The strategic importance of the item that is supposed to be purchased. An item may be strategic in several different ways for a company, mainly this criteria aims to determine how much profit impact the certain item has. Several authors, e.g. Gelderman and van Weele (2005), has paraphrased the title of the axis into *profit impact* instead of *importance of purchasing* which is the phrase used when the model first was introduced. The first input parameter has an internal focus; the profit impact is mainly affected by internal factors. (2) The complexity of the supplier market. The supplier market varies a lot depending on the characteristics of an item. Some items have thousands of possible suppliers while others only are available from a single supplier. Risk is also a part of this parameter as well as different trends such as globalization. This input parameter is mainly affected by external factors; the focal company cannot by itself force the market to go in one way or another, therefore, an adaptation is necessary. The external factors are affected by several different parameters such as natural disaster, consolidation of the supplier market etcetera. By using these two parameters a company can both utilize the purchasing power and reduce risks to a minimum (Kraljic, 1983).

The four quadrants in the Kraljic matrix

Figure 8 contains four different quadrants of items a company purchase. Even if the figure has sharp edges between the different quadrants the reality is often not as clear cut. Products can be more or less significant in a certain quadrant and there might be products that switch quadrant over time.

In the upper left corner of the matrix are the leverage items. As obvious from the axes these kinds of items have a big impact on the profit, while the supplier market's complexity is low such as electronic motors and heating oil. Since the supply complexity is low the focal company can exploit the purchasing power in negotiations aiming cut purchasing costs. To be able to renegotiate contracts with suppliers a short-medium term time horizon is preferred (Kraljic, 1983). The decisions regarding strategies and relationships are on a medium level, i.e. chief buyer is often responsible for the decision making in questions for this category.

In the upper right corner of Figure 8, the quadrant is labeled *Strategic Items*. These items have both a high profit impact and a high complexity in the supplier market. These items have often a close connection to the core competencies of the focal company.

Sourcing strategies for injection system in heavy duty diesel engine (HDE) case

This case describes how two independent HDE manufacturers source injection systems. In a heavy duty diesel engine the injection system is a very important component. How the diesel is distributed when injected is crucial for the combustion process and the performance of the entire engine and since the fuel consumption is important when the customer chooses engine the injection system has a great profit impact. The supply market for injection systems is characterized by a few large actors. Since the item scores high on both input parameters it will be classified as a strategic item for a manufacturer of heavy duty diesel engines. Even though the importance of the component is almost the same for manufacturer A and B, they have treated the strategic item differently.

Manufacturer A came to a point where it could not find any satisfying supplier of injection components to its new engines both regarding technology and price; no present solution seemed to be good enough. To solve the lack of supply and competence manufacturer A made the choice of starting a joint venture with a provider of injection systems aiming at developing a world class solution for injection systems in HDE. The provider itself is one of the large suppliers of injection systems but is also a manufacturer of diesel engines. However, even though both manufacturer A and its new partner offer diesel engines they are not competitors; they focus on different markets. Nowadays the joint venture company offer solutions that are available for other engine manufacturers and the cooperation between the provider and manufacturer A is getting deeper and in the future it is likely that they will collaborate to a larger extent and share more components in their engines. Since the two companies are getting into a deep relationship it will render difficulties for both manufacturer A and the provider to switch supplier of injection systems.

Manufacturer B has made the choice of sticking to another kind of strategic solution; it uses the best concept available at the market for its demand. When a contract is going to be phased out a request for quotation is done and the best suited supplier is selected. However, manufacturer B does not buy a final solution. The concept is adapted to the manufacturer's environment and the cost for the adaptation is carried both by the manufacturer B and its supplier, the time horizon for this kind of contracts if often up to ten years. The fact that manufacturer B and its injection system supplier adopt the concept and develop a customized solution jointly make the time horizon quite long, an agreement can approximately last for ten years.

Comparing the two manufacturers, A has the possibility of receiving an even more customized injection solution than B do, since it can affect the product development process in

> an earlier phase, but A is also to a larger extent locked to its current supplier and that solution due to its ownership in the joint venture injection provider. Another significant difference between manufacturer A and B is their volume. Manufacturer B has a larger annual volume of engines than A and can create economies of scale for the R&D process internally. Manufacturer A uses its joint venture in order to reach large volumes and economies of scale and get a reasonable unit cost for the solution.

The *Sourcing strategies for injection system in heavy duty diesel engine case* gives an example of strategic items and also highlights that the same need can be fulfilled in different ways. These kinds of relationships are managed at a top level, for instance by the purchasing president (Kraljic, 1983).

Down in the left corner of Figure 8 non-critical items are located. These items have neither high profit impact nor a complex supplier structure. It might for instance be standardized nuts and bolts in a manufacturing company. The relationships between the buyer and supplier are more on a transactional level and on short-term basis. Focus in the purchasing activities is on efficiency and inventory optimization and responsibility for decisions are dedicated to the purchaser personnel itself (Kraljic, 1983).

In the last corner of Figure 8 the bottleneck items are to be found. These items have a small profit impact but a high complexity in the supply market. Examples of these items are items with limited supply due to competition on the buyer market. Since it has a low profit impact for the buying company the willingness to pay is less than if it would have had a high impact. If the supplier gets the possibility to sell to another buyer who pays more there may be a risk of shortage of material in the supplier market. To cope with these challenges companies uses volume insurances; the supplier guarantee to supply certain volumes and if it doesn't manages a fee will be charged. The contracts tend to be long- term and the decision level is often at the head of department level. All four categories are summarized in Table 3 in order to get an overview of the differences between different categories.

Table 3. Characteristics of the different categories in Kraljic's portfolio matrix (Kraljic, 1983)

	Leverage items	Strategic items	Non-critical items	Bottleneck items
Management	Material management	Supply management	Purchasing management	Sourcing management
Key performance criteria	Cost/price and materials flow management	Long-term availability	Functional efficiency	Cost management and reliable short-term sourcing
Typical sources	Multiple suppliers, chiefly local	Established global suppliers	Established local suppliers	Global, predominantly new suppliers with new technology
Time horizon	Varied, typically 12-24 months	Up to ten years; governed by long-term strategic impact (risk and contract mix)	Limited; normally 12 months or less	Variable, depending on availability vs. short-term flexibility-trade-offs
Items purchased	Mix of commodities and specified materials	Scarce and/or high value material	Commodities some specified materials	Mainly specified materials
Supply	Abundant	Natural scarcity	Abundant	Production-based scarcity
Decision authority	Mainly decentralized	Centralized	Decentralized	Decentralized but centrally coordinated

The item classification may vary over time due to changed demand and competition in the market. It is of importance to take into consideration that the classification should be dynamic and therefore there is a need to re-classify the items.

Four stages in order to shaping a Supply Strategy

The supply strategy shaping process in the Kraljic portfolio method is made in four steps (Kraljic, 1983). (1) The first step is more or less about what this chapter has been about so far; *classification* of the item that is supposed to be sourced. As mentioned in previous sections the classification will vary over time and a product can move from strategic to non-critical as it moves on in the product life cycle. Movement in the opposite direction is also possible as lack of natural resources can make for instance coal switch from a non-critical to a strategic item. All four categories require different kinds of relationships between the buying and selling company (Kraljic, 1983). (2) Next phase is about *market analysis;* ten different criteria that according to Kraljic (ibid.) should be evaluated are available in Table 4.

Table 4. Kraljic's purchasing Portfolio Evaluation Criteria (Kraljic, 1983).

	Supplier strength	Company Strength
1	Market size versus supplier capacity	Purchasing volume versus capacity of main units
2	Market growth versus capacity growth	Demand growth versus capacity growth
3	Capacity utilization or bottleneck risk	Capacity utilization of main unit
4	Competitive structure	Market share vis-à-vis main competition
5	ROI and/or ROC	Profitability of main products
6	Cost and price structure	Cost and price structure
7	Break-even stability	Cost of non-delivery
8	Uniqueness of product and technological stability	Own production capabilities
9	Entry barrier	Entry cost for new sources versus cost for own production
10	Logistics solutions	Logistic

Most of the criteria in Table 4 are related to handle risk. The break-even stability for the supplier can for instance be used in order to evaluate how the certain supplier is affected by a drop in demand. It is necessary to get a god understanding for the market situations in order to minimize the risks of lacking supply in a future state. The focus when doing the market analysis is on both quality and quantity of the components. (3) The market analysis is followed by a *Strategic positioning.* In this phase the focal company's position is compared to the suppliers' position. By investigating who is dependent of whom the focal company get an understanding of how much it can exploit its purchasing power with a minimum risk. (4) The last phase in the strategic shaping process is *Action plan.* Here a setup for each single item is planned, the results from previous stages may end up in that a certain sourcing strategy is the optimum in order to maximize purchasing power and minimize risk. When the strategy is settled it is time to focus on which supplier/suppliers to choose in order to get the best solution.

Kraljic (1983) gives some kind of a rule of thumb in what mode the relationship should be for the three different situations: supplier strength is dominant, focal company strength is dominant, or none of the parties are dominant. When the supplier is dominant the focal company should go for diversified purchasing and be careful during negotiations in order to secure the supply. In the opposite way, when the focal company has the strength it can be more aggressive and spread volumes between different suppliers in order to create a competitive climate and cut prices. When the dependency is balanced there is an opportunity for some price negotiations even if the supplier cannot be pushed too aggressively. The more specific supplier selection processes are not included in the Kraljic Portfolio.

Suitable relationships

To investigate when which kind of relationship should be used a study made by Caniëls and Gelderman is used as a basis. 250 Dutch purchasing professional have taken part in a survey and the relation between buyer and seller dependencies is evaluated (Caniëls & Glerderman, 2005).

Suitable relationships for Leverage items

Since leverage items have a low complexity in the supplier market it is often possible to source the item from several suppliers. Therefore, the buyer has several different possibilities for sourcing the product and has a low risk of standing without a supplier due to pushing the suppliers to cut cost. For this category of items Caniëls and Gelderman (2005) suggest two different kinds of relationships. (1) *Exploit buying power;* the buyer creates competition among possible suppliers in order to cut the price. The contracts are generally on short-term basically to enjoy the possibility to frequently renegotiate the contract and in case of a better offer, switch supplier or share of supply between different suppliers. By using this approach the focal company uses its negotiation power and the behavior is therefore useful when the suppliers are more dependent of the buyer than vice versa. (2) Another strategy that may be useful for leverage items is to *develop a strategic partnership.* This strategy might be useful when the dependency among the focal company and supplier is balanced. The strategic alliance makes it possible to increase the involvement in the product and maybe take part in research development process at the supplier in order to develop the performance of the item. By continuously improving the product, cost cutting possibilities hopefully occur and the profit for both the focal company and the supplier can be optimized.

Suitable relationships for Strategic items

Since the complexity of the supplier market is high there are only a few suppliers, sometimes only one, providing the possible solution required. The relationship with the supplier is therefore crucial for the success of the business. Caniëls and Gelderman (2005) highlight three different kinds of partnership in order to cope with the limited supply possibilities. (1) *Maintain strategic partnership* has been used by companies to cope with the supply risk almost since Kraljic introduced the importance of strategic purchasing (Elliot Shire & Steele, 1985). The relationship is much about mutual trust and commitment, manufacturer A in the case description presented previous in this chapter uses this kind of relationship with its injection supplier. Both supplier and buyer put a lot of effort into the relationship and its development. The parties try to create a win-win situation. (2) In *Accept locked-in partnership* the buyer has a trickier situation, since the buyer is more or less forced to use a certain supplier. It may be because there is only one provider available. Neither the focal company nor the supplier usually are interested in developing this kind of partnership to a deeper level, therefore it tends to create less interdependencies than the first alternative (Caniëls & Glerderman, 2005). (3) *Terminate a partnership* this strategy is used

when the focal company actually wants to decrease its dependency on a specific supplier. Imagine for instance that manufacturer A wants to find a new solution for the next product generation, only by not involving the joint venture when designing next generation it starts to termite the partnership. Of the three alternative partnership setups the interdependency tends to be on the lowest level in alternative three.

Suitable relationships for Non critical items

The low profit impact products with low supply complexity often do not cause any major problems for a purchasing organization. However, even though this product often only represent 20 % of the purchasing turnover, as a rule of thumb purchasing departments tend to spend about 80 % of their time on managing these kinds of products (Caniëls & Glerderman, 2005). It is therefore important to find effective ways of treating these relationships in order to have more time to spend on the relations that actually generate a high profit impact, i.e. leverage and strategic items. According to Caniëls and Gelderman (2005) there are two different strategies to manage these relationships. (1) *Pool purchasing requirements* aiming to reduce the administrative and logistics complexity for each purchase. Single items are grouped into systems in order to decrease the number of purchasing activities. (2) *Individual ordering, efficient processing* is another strategy to solve the same issue. This strategy is mainly used when the pool purchasing strategy mismatch the item pattern. The main target is to reduce the indirect purchasing cost, an example can be that the buyer shoots a barcode and by that sending a standardized order to the supplier instead of expediting the ordering activity manually. These two methods may also be possible to combine; the pool purchasing procedure sometimes is possible to standardize in order to decrease both the number of transactions and the indirect purchasing cost for each single transaction.

Suitable relationships for Bottleneck items

These kinds of relationships are a little bit special and as a buying company it is important to be careful when negotiating. The buying company often has to accept that the supplier has the negotiation power and if the demand exceeds the available supply the supplier will probably prioritize the most profitable customers. Therefore it can be a disadvantage to push the supplier to cut the prices. Caniëls and Gelderman (2005) suggest two types of action for meeting a bottleneck relationship. (1) *Accept dependence, reduce negative consequences* is the first approach. The main focus is to minimize the risk of being out of supply by letting the supplier be satisfied. Another way of accepting dependency is to keep inventory of the component at the focal company. The total cost will probably increase as well as the risk of components becoming obsolete, but the supply risk is minimized. (2) *Reduce dependence and risk, find other solutions.* Another way to handle the bottleneck items is to actually get rid of the root cause. If it is lack of a certain raw material the focal company should try to come up with a new solution that is not dependent on the specific raw material and in that way eliminate the bottleneck to an as large extent as possible.

Dependencies in the different types of relationship

To get an enhanced understanding of how the different relationship types impact the dependency, the results from the dependency survey presented by Caniëls and Gelderman (2005) are shown as a graph in Figure 9.

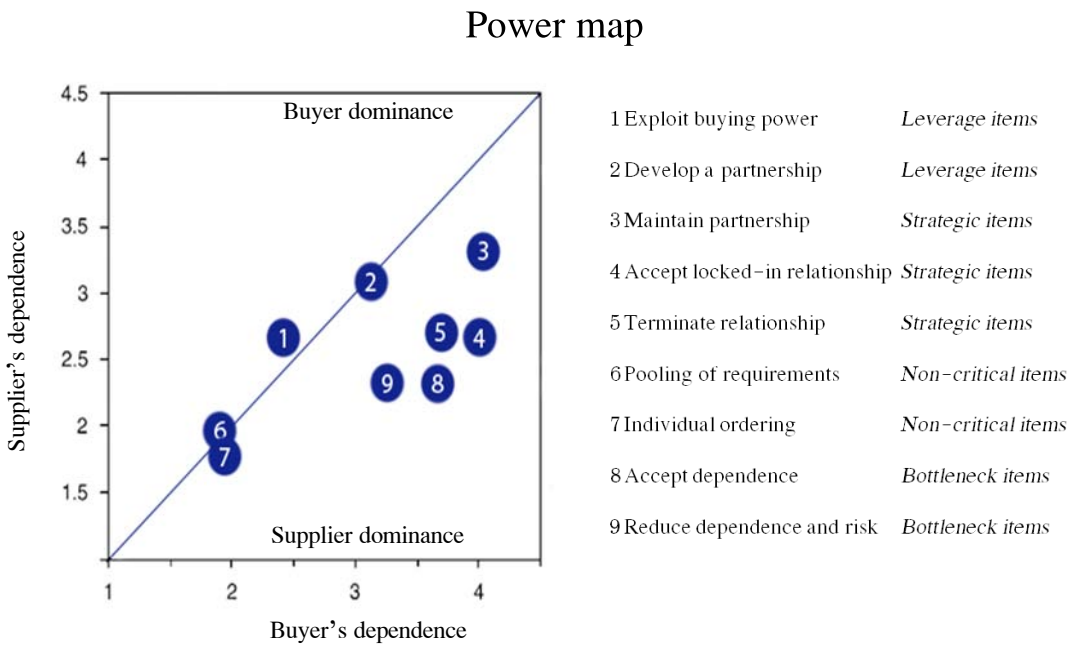


Figure 9. Power map of supplier versus buyer dependencies. Data from Caniëls and Gelderman (2005)

From Figure 9 it is clarified that the suppliers tend to have the dominance in relationships regarding items with high supplier market complexity. However, for products where the buyer has the possibility to exploit its power the dominance tends to be balanced, not dominated by the buyer as could have been expected according to the theories that Kraljic (1983) introduced about exploiting power. The dominance is also affected in a specific category; both relationship number 3 and 4 are for instance suitable for strategic items, the buyer dependency is almost equal while the supplier dependence vary. Since it only was the purchasing part of the relationships that took part in the survey, it does not reflect how the suppliers perceived the relationship dependencies.

Applicability of the Kraljic Matrix

It is no doubt that Kraljic has had a large importance for the development of purchasing portfolio models. His model has been referred to in almost 1000 items but how applicable the model is can be questioned. The model has a great impact on the perspective of purchasing as a strategic function and explains in a clear way the importance of developing different kinds of relationships in order to enhance the profitability of the focal company. It also provides the focal company the possibility to differentiate among different kinds of products in order to exploit its purchasing power at maximum with a minimum risk (Lilliecreutz & Ydreskog, 1999). The two axes also connect the model both to internal and external aspects which give the possibility of a good holistic view of the actual situation. However, there are some critics and weaknesses in the model.

One unclear parameter is how the input values should be measured. Profit impact can probably be measured in some quantitative way even if the scale is unknown in the model but the complexity of the supplier market is difficult to measure. What is high complexity and what is low complexity then? Another issue related to the input axis is what to include; if too many sub parameters are included in the supplier market complexity, almost all connections tend to be complex and the axis loses its value. It is also possible to question the choice of parameters; why are these optimum (Nellore & Söderquist, 2000)?

Some authors highlight a lack of research and case studies investigating the performance of the model. Positive arguments about purchasing portfolio models tend to have qualitative values, while negative arguments are based on quantitative data and conceptual studies (Gelderman & van Weele, 2005). When a strategic relationship is settled the interdependencies tend to increase. One example is the engine manufacturer A in the case presented earlier in this chapter. The joint venture for injection components continues evolving and the commonalities between the focal company's engines and the provider's engines will probably continue to increase and involve more than injection components. The Kraljic portfolio model does not consider the wider and more complex network perspective when describing possible relationship links between parties in a supply chain (Dubois & Pedersen, 2002). This can in certain areas be seen as a weakness.

The Kraljic matrix has been wide spread throughout the industry by being an easy to grasp yet strong model. The output from the model can be used as assistance to the purchasing department in order to help the company stay competitive.

SUCCESSOR MODELS TO THE KRALJIC MATRIX

Since Kraljic presented his model in 1983 several authors have presented portfolios for supply base structuring. Most new portfolios build in some sense on Kraljic's but have in most cases either shifted focus to buyer supplier relationships or added that to their product categorization. Not all new supplier base portfolios created will be presented here but instead a few so that the reader will understand the basic trend of new portfolios.

Olsen and Ellram (1997): Including relationships in a matrix portfolio

In 1997 Olsen and Ellram presented a portfolio model that built on Kraljic (1983). As can be seen in Figure 10 their model uses a similar matrix but has the axes "difficulty of managing the supply situation" and "strategic importance of the purchase". In contrast to Kraljic's model where the focus is on how to exploit one's buyer power as much as possible, Olsen and Ellram (1997) present a three step process on how to manage the relationship with the supplier.

As stated before, the first step is to categorize according to the matrix. In order to do this Olsen and Ellram (1997) present factors that influence either the difficulty of managing the supply situation or the importance of the purchase. Within these categories these factors are grouped into three different sub categories. The factors influencing the strategic importance of the purchase are competence factors, economic factors and image factors. These factors can be seen in Table 5.

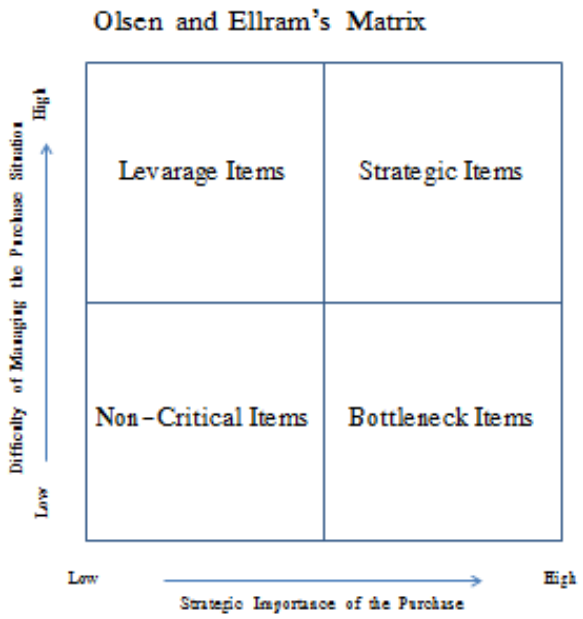


Figure 10. A matrix portfolio adapted from Olsen and Ellram (1997)

Table 5. Factors influencing the strategic importance of the purchase (Olsen & Ellram, 1997)

Competence factors	Economic factors	Image factors
- The extent to which the purchase is part of the firm's core competence - Purchase improves knowledge of the buying organization - Purchase improves technological strength of buying organization	- Volume or dollar value of purchases - The extent to which the purchase is part of a final product with a great value added - The extent to which the purchase is part of a final product with a good profitability - Criticality of the purchase to get leverage with the supplier for other buys	- Supplier critical image/brand name - Potential environmental/safety concerns

Factors influencing the horizontal axis, *the importance of the purchase*, are grouped in three different sub categories. These are *product characteristics, supply market characteristics* and e*nvironmental characteristics* and these factors can be seen in Table 6.

Table 6. Factors influencing the importance of the purchase (Olsen & Ellram, 1997)

Product characteristics	*Supply market characteristics*	*Environmental characteristics*
- Novelty - Complexity	- Suppliers' power - Suppliers' technical and commercial competence	- Risk - Uncertainty

The company conducting the analysis should add weights to the different factors so that the ones that influence their company most are treated as the most important (Olsen & Ellram, 1997). After plotting them into the matrix the different products will end up in one of four cells. These cells are the same as those described by Kraljic (1983) and these are non-critical, leverage, bottle neck and strategic. The characteristics for these cells are roughly the same as for those presented by Kraljic (1983).

The second step of the process is to analyze the supplier relationships. Kraljic (1983) suggest that one should exploit one's buyer power if possible but Olsen and Ellram (1997) objects and presents that as shortsighted and dangerous. Instead Olsen and Ellram (1997) present several factors that need to be considered where buyer power is one factor. These are summed up in a matrix, see Figure 11, where one axis is t*he relative supplier attractiveness* and the other is the *strength of the relationship*. Since the factors that affect these axes will vary in different industries, it is important that one uses a contingency approach when deciding these (Olsen and Ellram, 1997).

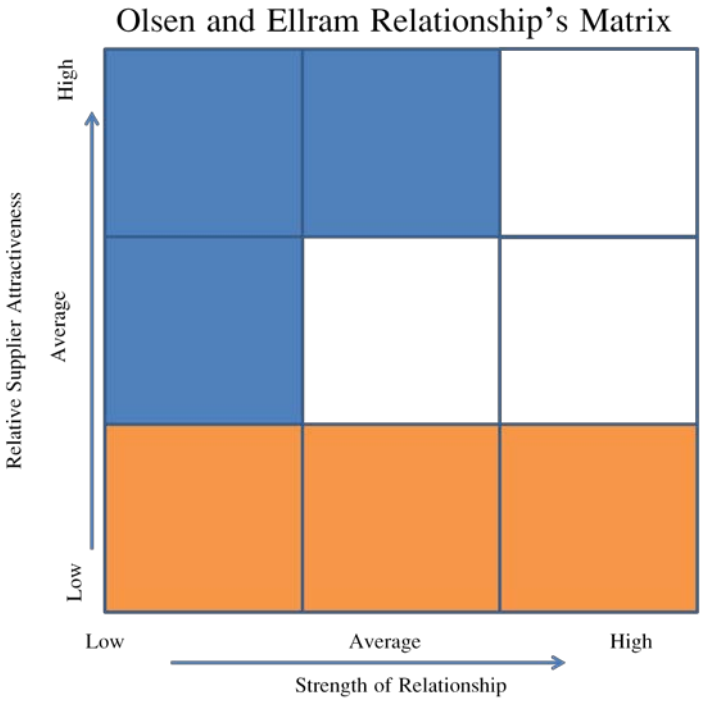


Figure 11. Relationship categorization based on Olsen and Ellram (1997)

The relative supplier attractiveness consists of the factors that make one company choose another as its supplier. Even though a contingency approach should be used, these factors can be categorized and

grouped into sub-categories and these are in general; *financial factors* such as the supplier's margins and its financial stability, *performance factors* as for example quality and price, *technological factors* such as the ability to cope with technological changes and patent protection, *organizational, cultural and strategic factors* as for example the strategic fit between the buyer and supplier and the feeling of trust between them and finally *other factors* as safety and risks for natural disasters for example. The second axis is the strength of the relationship and these factors describe the bonds between the two companies. The different factors are grouped into four groups and these aim to cover all aspects regarding the bond between the companies. The groups are; *economic factors* which for example are the exit costs or the value for the buyer in terms of percentage of total costs, *the character of exchange relationship* such as the level of personal contact and the duration of the exchanges, *the cooperation between the buyer and supplier* which can be joint product development or integration of management and finally *distance between the buyer and supplier* which can include cultural, physical and/or technological distance.

After categorizing the products and the relationships, the third step is to develop action plans in order to have the best fitted relationship with the supplier based on the categorization of the products. From Figure 11 one can see that the blue cells describe a high to moderate supplier attractiveness and a low to moderate average relationship strength. If the supplier provides an important and strategic product it is important to try to strengthen the relationship. The relationship can for example be strengthened by involving the supplier in product development and/or by increasing the purchased volume (Olsen & Ellram, 1997). The latter is a way of strengthening the relationship without putting in more resources into it. However, that could have other implications to. The white cells in Figure 11 include where the supplier has a moderate to high attractiveness and where it also is a relatively strong relationship. Here the focus is to maintain the strong relationship with the supplier which can be done by reallocating resources within different activities in order to maintain the strong relationship. The orange area in Figure 11 consists of suppliers with a low attractiveness. The strategy that one should consider is whether one really needs them as suppliers. A good strategy could perhaps be to look into changing them. One should also consider action plans for where there might be a large mismatch between the relationships and the products bought.

As stated by Olsen and Ellram (1997) their research is based on a survey with a large amount of firms. However, each firm has only used one product per supplier and this might influence the strategy. The portfolio strategy does not consider what kind of relationship one should develop if a supplier has different products within different cells.

Bensaou (1999): Using supplier and buyer investments when managing the purchase situation

Kraljic's (1983) matrix focus on differencing the company's products based on the characteristics described earlier. Spawning from that matrix, Bensaou (1999) describes a matrix with a different focus. Instead of focusing on the products itself, the focus is put on the interaction between the buying and selling firm and the dependencies between them, which is seen in Figure 11. The reason for this change is due to that managers have been advised to move away from arm's length relationships so that they instead can focus on building relationships with their suppliers. However, even though strategic partnerships create new values they are costly to develop, nurture and maintain. Bensaou (1999) propose different strategies towards different suppliers based on what relationship one would want to have with them.

The different relationships are based on the specific investments made by either partner in the relationship. This is due to that there is a strong correlation between specific investments by the partners in the relationship and practices that are commonly associated with strategic partnerships such as long-term relations, mutual trust and cooperation (Bensaou, 1999). These are investments that are hard to transfer to another buyer or supplier and in such case might lose their value. Buyer specific investments are for example investments in buildings, tools and equipment that are dedicated only for the supplier. It also includes intangible investments such as people spent learning the supplier's routines developing the relationship, for example. This time could otherwise have been spent on developing new businesses with other suppliers. The supplier specific investments are similar and include tangible investments such as locating a plant or warehouse close to the supplier and also intangible investments such as sending guest engineers and synchronizing information systems.

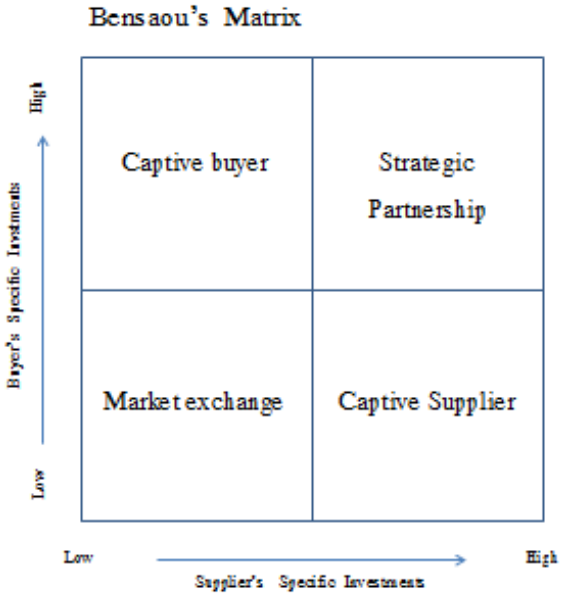


Figure 12. A matrix portfolio based on buyer and supplier investments, adapted from Bensaou (1999)

Contextual profiles

Bensaou (1999) identifies different contextual profiles with several general characteristics within the four cells in his matrix. These can be grouped into:

- Product Characteristics
- Market Characteristics
- Supplier Characteristics

Having a relationship with low buyer's specific investments and low supplier's specific investments indicate that the interaction between the firms are generally low when conducting business. Product characteristics that often can be identified are for example that the products are generally standardized with a mature technology. Products in this category are also often technically simple and with low innovation rate as well as rare design changes. The market characteristics that can be identified in this category are that the market is fairly stable or declining and that there usually are many suppliers available. General characteristics for the supplier are often that there are low switching costs and that they have a low bargaining power.

If there are low buyer specific investments and high supplier specific investments Bensaou (1999) describes this as a captive seller. This can be seen in bottom right cell in Figure 12. The product characteristics in that cell are generally that the products are technically complex and that there is a high frequency of new innovations together with heavy capital investments. For the market characteristics there is generally fierce competition between suppliers and a highly volatile market with frequent technology shifts.

The top left cell is called the captive buyer cell and that is when there is high buyer specific investments and low supplier specific investments. The product characteristics in this cell are generally technically complex products that are based on a mature technology. There is also often little innovation and development of the technologies. The market is often considered to be stable with few established players. The suppliers are generally large firms with strong bargaining power and usually it is the suppliers that own the technology.

The last cell is where there are both large supplier and buyer investments. This is the cell in the top right corner and it consists of strategic partnerships. The product technologies here usually require a high level of customization where tight mutual adjustments are needed in order to be successful. There are large capital investments needed and design changes are frequent. The market is generally high-growth with frequent changes in competitors due to unstable or lack of dominant design. The suppliers, or partners, are usually strong multiproduct supply houses with strong technology bases. They are usually active in both research and innovation.

Management profiles

According to Bensaou (1999) there are no statistically significant performance differences between the different cells. No type of partnership is fundamentally better than another, not even the strategic partnership. Successful supply chain management therefore requires firms to adopt the specific requirements and benefits that each cell represents. Bensaou (1999) instead identifies differences between the high and low performers within the different cells.

High performers within the market exchange cell usually only have contact during bidding and transactions. The suppliers usually do not interact with the design phase and contacts are kept to a minimum.

Within the captive buyer cell, high performers can be identified as those who, despite the need for high customization, can break down the operational coordination into clear and manageable steps and procedures. In addition it is also important to have a high degree of communication between the buyer and supplier within different departments in the companies such as design, manufacturing and quality. Those working within the interaction between the firms should have structured and highly predictable tasks but at the same time acknowledge that they need to spend a large amount of resources on dealing with the supplier. Even for high performers the social climates in these relations are usually quite tense with high distrust between both parts.

The strategic partners are when both parts make considerable investments and high performers can also be identified in this category. Those are usually those who share a lot of information in a standardized way through reports, rules, operating procedures and face-to-face meetings. The buyer usually spends a lot of time together with the supplier staff in order to coordinate tasks and less time monitoring the supplier. These relationships are characterized as trusting and collaborative and both actors display high commitment in order to do joint operations.

Compared to the other three clusters, high performers in this cell place small emphasis on information exchange. The main communication focus on the coordination of possible complex tasks and the buyer spends little time developing the relationships. Face-to-face meetings are generally the supplier's concern to set up. The social climate in these relationships is often characterized by high levels of mutual trust and this is due to the lock-in effects.

Bensaou (1999) states that in order to have a successful relationship with suppliers, the buying company must balance the investment in the relationship with benefits from the relationship. If one over- or underinvest in the relationship one either has increased costs or increased risks. Often it can be hard to influence the cell in which the relationship is and it is therefore important to handle it in the right way.

Gelderman (2003): New perspectives on the Kraljic matrix

Gelderman's (2003) matrix is built on Kraljic's (1983) matrix and concludes that it has some unanswered questions. The matrix provided by Gelderman (2003) is not new but instead a rework of Kraljic's with the goals to provide new perspectives on the buyer-seller dependencies and also the resource dependency.

In Kraljic's matrix the leverage area is generally considered to be the most favorable because of the exploitation of full purchasing power due to the combination of low supply risk and high profitability (Gelderman, 2003). In contrast, the lower right corner with high risk and low profitability decreases the power of the buyer and increases it for the supplier. By adding a line from the top left to the bottom right it can represent a power axis. Between these extremes there is a zone where the parties are expected to have some kind of balance.

Another axis could also be added. If the products are highly profitable with an high supply risk they should be considered as strategic and important. If on the other hand the profits and supply risks are low, they would not be very important for the buying firm and from this one can draw an importance axis from the bottom left to the top right. In a world were raw materials and resources are getting scarcer it can be very valuable to identify these resources in order to secure supply.

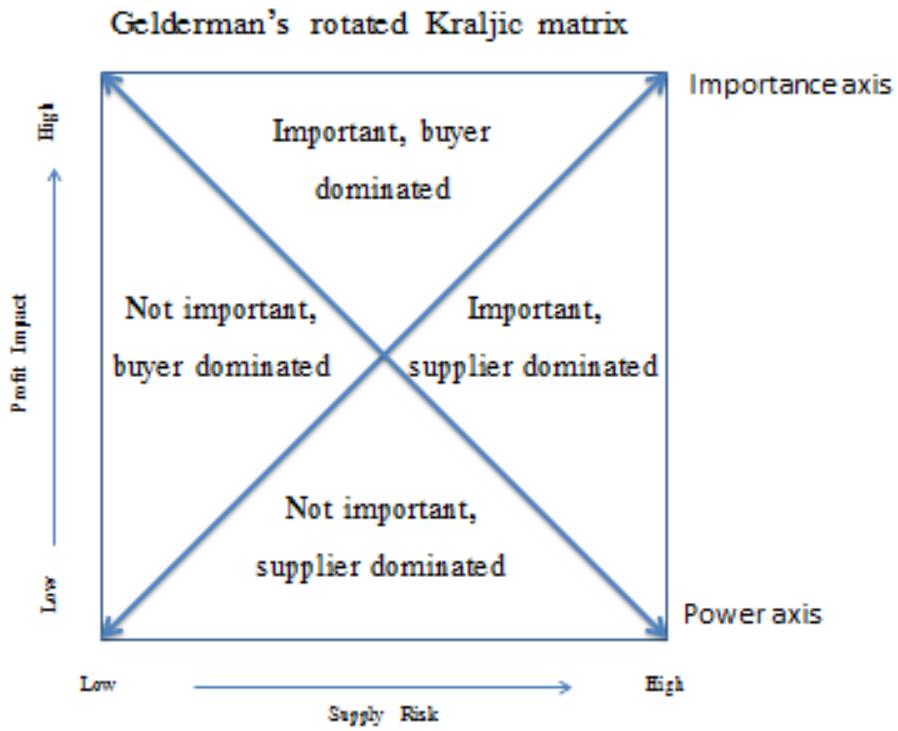


Figure 13. A rotation of Kraljic (1983) matrix adapted from Gelderman (2003)

Having derived the original axes from Kraljic's matrix, a new matrix has appeared. This matrix is actually a rotation of the original matrix, see Figure 13, and this combines the original dimensions with the new ones, importance and power. Given this, new perspectives can be seen on the matrix which takes the buyer and supplier power structures in consideration. Going back to the cells in Kraljic's matrix one can see that:

- Items in the leverage corner are buyer dominated and can either be important or not important
- Strategic items are important and can either be supplier or buyer dominated
- The bottleneck cell is supplier dominated and the products can either be important or not important
- The non-critical articles are not important and can either be supplier or buyer dominated

Reducing risk with dual sourcing at Mölnlycke Health Care - Surgical division

The Surgical division at Mölnlycke Health Care always tries to have at least two suppliers for strategic products. This is done for several reasons. The main reason is to reduce risks that can be tracked to supply shortages due to natural disasters and production failures at suppliers. Using dual sourcing for strategic articles greatly reduce these risks according to the company. Another reason for dual sourcing is to reduce the commercial risks that are present in some of the company's supplier relationships, namely in the cases where the purchased volumes are so small that the company is not seen as strategic. This might create problems and using dual sourcing can support decreasing the risk.

Knowing that there is a differentiation within the cells in Kraljic's matrix, it can help counter an over-simplistic view on the original matrix and also add buyer-supplier power in the matrix. The buyer-supplier dominance can play a major roll when choosing supply strategy. As presented in the case with Mölnlycke Health Care, the company uses dual sourcing in order to mitigate the risks of having a supplier dominated relationship. A study by Baatz (1999) show that smaller firms are more likely to have sourcing from several firms while large firms rather want to develop strong relationships with a few supplier. A large part of this probably is due to the supplier-buyer strength (Baatz, 1999).

Gelderman's matrix creates new views on the matrix by Kraljic by including new axes and involving supplier-buyer power. This gives new perspectives on Kraljic's matrix and increases its boundaries.

SUMMARY AND COMPARISON OF THE MATRIX MODELS

The Kraljic model has greatly influenced the successor models and its heritage can be found in most new models. However, there has been some shift of focus with newer models. Kraljic's model had a strong focus on the products while newer models either focus on the relationship (Bensaou, 1999) or focus on both the product characteristics and the relationship (Olsen & Ellram, 1997). These changes could have spurred up both because of the increasing importance of purchasing and also the increased focus on more strategic partnerships.

All alternative portfolio models compared in Table 7 are in some way based on Kraljic's, but have tried to develop the model and increase its applicability. One critic of Kraljic's model was that the two dimensional inputs perspective is too simple to accurately catch the real situation. The reality is far away complex. One obvious issue is to keep the portfolio model simple and at the same time have enough input to succeed to give a trustworthy output. The relationship perspective has already been added to the portfolio model, but since the variety, complexity and heterogeneity, as described in Chapter 1, has created new challenges among companies there is probably a need to continue developing this parameter. The models lack of focus on interdependencies; relationships are often investigated in a single link perspective but the reality is getting more complex and is nowadays more described as a network instead. Therefore it is a need of the portfolio model to follow and take the network perspective into consideration. Finally, if a portfolio matrix model is going to be useful as a tool on a modern purchasing department it has to be simple to use, but take a lot of dynamic variables into consideration in order to give an accurate output.

Table 7. Comparison of portfolio matrix models' benefits and drawbacks

Portfolio model	Input	Output	Benefits	Drawbacks
Kraljic (1983)	- Profit impact and Supply market complexity	- How to exploit maximum power to minimum risk for a product	- Clear and easy to understand - Highlight importance of purchasing - Combine external and internal factors - Give possibility to differentiate resources between different item categories	- Difficult to measure input parameters - Too simple to reflect reality - Takes no relationship matter into consideration
Olsen and Ellram (1997)	- Difficulty of managing the purchase situation and strategic importance of the purchase	- Strengthen the relationship - Improve the supplier attractiveness/ performance - Reduce resources used in the relationship	- Involve relationships in the matrix - Provides strategies on how to handle different relationships	- More complex than Kraljic - Does not describe how to change the relationships
Bensaou (1999)	- Buyer's specific investments and Supplier's specific investments	- How to manage relationships within the different cells	- Easy to grasp - Highlights the importance of relationships	- Simplifies the reality - Assumes that all products from one supplier are in the same cell
Gelderman (2005)	- Profit impact and Supply market complexity	- How to handle the cells in Kraljic's matrix with supplier and buyer dominance	- Provides new perspectives on the Kraljic matrix - Places more value on supplier and buyer dominance	- Harder to understand than the Kraljic matrix

CHAPTER 3

TRENDS INCREASING THE IMPORTANCE OF EVALUATING THE SUPPLIER BASE

In Chapter 3 different trends that effects, or have affected, the supplier base and its structure are presented. The chapter is divided into mega trends, market trends and business trends that all describe different amd important trends based on the different level. The mega trends are trends that largely affect businesses on an aggregated level and not only the supply base strategies. Increasing oil price, scarcity of rare earth elements, shifting center of gravity and, access to capital is becoming more restricted. The market trends are shorter life cycles, increased customization and, interest for corporate social responsibility. These trends stem from consumer behavior and effects most companies and markets within most industries. Business trends are trends that can be tracked to single corporations. The business trends described are; the focus on core competence, the need to understand risk, product strategies that affect purchasing and, servitization of products.

MEGA TRENDS

On a global level a number of trends with a significant effect on businesses are apparent. The four trends identified and presented are increasing oil price, short supply of rare earth elements, shifting center of gravity and, access to capital is becoming more restricted. These global trends have in most cases a considerable impact on a company's profitability, mainly due to increased costs within several areas such as logistics, funding and raw material acquisition. These costs cannot with ease be transferred downwards the supply chain towards the end customer since the customer value hasn't been enhanced by the increase of costs. This situation is of course challenging and measures have to be taken by companies in order to maintain profitability. Evaluating the supplier base and exercising appropriate changes to its structure is one way of dealing with these challenges.

Increasing oil price

There is no question that businesses around the world are affected by the price of energy, in particular the price of oil (Zittel & Schindler, 2007). The oil price has surged the last decade and the long-term trend is a further incline (OPEC, 2011). A reason for the increase in oil price is basically that demand has outstripped supply (Christopher, 2011). The peak oil theory leads to believe that the demand for oil will be even harder to fulfill in the long run (Zittel & Schindler, 2007), especially considering the trend of increasing demand (OPEC, 2011), which also point in the direction of an increased oil price. Demand has increased partly from the emerging markets of the Asia Pacific (APAC) region and the shortage of supply is due to that oil production at present is not expanding (Christopher, 2011) This is a result of low oil prices up until the early 1990s, not creating any great incentives to invest in oil production which in combination with long lead times of such projects has created a lag between the sought for volumes and the ones being provided. Furthermore production in itself has become more expensive due to increased license costs and also to the fact that production in some regions has become more expensive due to political and ethnic conflicts (OPEC, 2011). Increased environmental concerns also are a source for increased prices on oil due to policies and regulations which are enforced in order to mitigate climate change (ibid.). In addition, the price of oil affects the price of other energy sources since it's used during extraction, processing and generation and distribution of for instance natural gas (Öhman & Rémond-Tiedrez, 2009).

Regarding the impact that energy prices and the oil price in particular have on the supply chain is to a large extent transport related, however also costs for raw material and packaging are closely related to the price of oil (Christopher, 2011). In the area of transportation the price of fuel is intimately linked to the cost of oil and a major cost driver, representing about half of the total transportation cost for transports carried out by truck (Wang, 2009). Further price increases will eventually call for an overlook of the logistics strategies utilized, in terms of shipping frequency, distances, fill rates and the choice of transport mode.

Altogether increasing prices on energy and oil in particular gives food for thought. Is it likely to believe that existing supply chain solutions may be unviable in a not so far away future? Rubin (2009) poses a picture of de-globalization of trade as an outcome when prices have reached a point when it is no longer economical to manufacture in countries far away from the market where the product is being sold. That is, the cost for transportation would outweigh the cost benefit that low wages provide. Thus investigating the outlooks for a local-for-local approach to manufacturing is a good idea in order to be proactive (Christopher & Holweg, 2011). Scenarios as this one will mildly put have a significant impact on the

supply network of a company. In the extreme case of moving extraction of raw material, manufacturing of components and final product assembly closer to the market the entire network structure could be altered. Companies can be forced to think in totally new ways upon how partnerships should be configured and who to collaborate with. Are there for instance any appropriate suppliers available on the local market? Should a company set up numerous small manufacturing and assembly entities or will another approach be necessary in order to gain economies of scale? For instance, should final assembly in the automotive industry be conducted by a third party specialized in assembly, who takes care of the assembly for several different brands on an entire market? This research area is wide open to speculate in and new ideas of network structuring can be of great help and an eye opener to the possibilities that emerge by new network formations.

It seems clear that increasing energy prices will have a substantial impact on manufacturing and distributing companies' costs. However to which extent depends on how big a cost driver they are and how well these companies manage to avert the impact of increasing energy prices. Given the approaching situation an advance towards incorporating the total cost of ownership into a supplier assessment model would be beneficial. In addition an assessment model would benefit from the possibility to evaluate the supplier's sensitiveness to increasing energy prices. Furthermore is would also be of great interest to map how well a supplier could cope with a development towards a local-for-local strategy.

Short supply of rare earth elements

As for oil, the demand for other raw materials also have increased in the wake of the growth of the emerging markets, leading to substantial higher prices for raw materials such as steel, copper, silver and gold (Humphries, 2011). This is obviously affecting businesses financially however, the raw materials of biggest concern are the ones denoted rare earth elements (REE) comprehending scandium and lutetium, for example. The reason is that supply itself is becoming a monumental bottleneck partly due to the introduction of Chinese restrictions on export and the lack of alternative sources (ibid.). Also the demand has increased in manufacturing of technology intense products such as automobiles (catalysts), wind turbines (generators) as well as cell phones and laptops (displays). The availability is also essential for batteries utilized in hybrid and electrical automotive engine solutions (ibid.). The latter is a great concern as these solutions are seen as substituting technologies to the oil empowered engine. It thus seems clear that the implications for a company falling short of REEs are very serious. Therefore it is essential to secure a supply base which can assure availability of the sought for volumes of this kind of material. Also suppliers which can contribute to technology and/or product development as a means to decrease or eliminate the need for such materials would be beneficial to engage. In the case of being exposed to possible bottlenecks of this kind, an assessment model taking such concerns into consideration would be of great use as a measure to decrease the risk of suffering from impaired delivery reliability.

Shifting center of gravity

In addition to the previous discussion concerning a local-for-local strategy this can at first sight easily erect a thought that a lot of production will be moved back to the economically developed countries of the west, from the APAC region for example. This will surely be the case however, due to the shifting center of gravity in several markets the opposite scenario is also likely. The emerging markets today have a middle class of 400 million which is projected to increase to about 1 billion in 20 years' time (Christopher, 2011). One of the implications of this will be that over 50 percent of the global economy by then will be centered

to the APAC region (ibid.). The combination of this and the unpredictable outcome of the unfolding economic crisis of the west will surely render a redistribution of wealth across the globe.

Even without high energy prices as an incentive to evaluate the supply network structure, the trend of shifting center of gravity imply that such an evaluation should be performed. Possible implications in the case of a closeness-to-market strategy are a redistribution of manufacturing and product development resources to the regions now experiencing a substantial growth of economic power. Such redistribution of course affects the supply network in terms of sourcing and setting up appropriate logistics solutions. Hence a supplier's possibility to follow such a development would be beneficial to incorporate in a supplier assessment model.

Access to capital more restricted

A more recent trend, which in a big way was set off by the financial crisis in 2008, is that the availability of capital has become more restricted, rendering a higher cost for capital (Jobst, 2010). Companies with sound economy and financial muscles still have ease of funding but companies imposing a higher financial risk to the lender experience increased difficulties to secure funding at the terms and conditions that was earlier present (ibid.). It should however be mentioned that companies, although still having ease of funding, of course aren't unaffected by the situation. By increased lending rates also the alternative cost increases for having fixed assets, hence an evaluation of a company's cost structure will most likely render a proposition to move away from fixed assets.

The implications this poses on a company's supply network is for instance a strive towards asset-lite supply chains. This implies outsourcing different activities currently being performed in-house such as production and product development, which already is common in today's business environment. Outsourcing obviously has a significant impact on a company's supply network in a number of ways. For instance establishing connections throughout the supply chain in terms of communication between members as well as which parts of the companies that should communicate with each other and how. A crucial matter here is how communication regarding joint product development is being performed, with regards to intellectual property issues. The case presented below exemplifies this issue.

Supplier relations at Mölnlycke Health Care regarding product development

Mölnlycke Health Care emphasizes that it is imperative that communication regarding joint product development with suppliers is run by the purchasing. The reason for this is to ensure appropriate financial and legal solutions in the event of for instance a new technology being jointly developed and commercialized. Since all employees aren't aware of the issues regarding intellectual property purchasing has given out a leaflet emphasizing the importance of how communication is to be conducted with suppliers.

Also connections regarding information sharing is to be set up as a means to decrease lead-times as well as master the bullwhip effect through increased transparency across the supply chain (Skjøtt-Larsen et al., 2007). This is for instance achieved by implementation of an electronic data interchange (EDI) and real-time information update by connecting certain enterprise resource planning (ERP) modules across the supply chain (ibid.). A supplier evaluation will thus have to take into account the possibilities of inter-organizational information sharing and the cost for establishing and maintaining such connections.

Furthermore, outsourcing also calls for finding logistics solutions which are appropriate with the manufacturing strategy, for instance in the case of sourcing components which are to be used in a just-in-time (JIT) setup. The geographical location of the supplier can in this case be of great importance, since it affects lead-times, making it favorable to locate suppliers close to the company's manufacturing facility. Also a postponement strategy can be utilized to support JIT in the event of a supplier being located far away (Christopher, 2011). That is, the manufacturing of a basic non-customized component can be carried out far away while the customization is performed closer to the purchasing company. An example would be fenders in the automotive industry being manufactured in a far away low-wage area being shipped to a workshop close to the manufacturing site of the purchasing company, where the fender would be painted according to the customer's specification. Of course also the use of a postponement strategy as the one mentioned affects the supply chain. Also outsourcing adds an element of risk by letting control of the outsourced activity. For instance regarding protection of intellectual property, securing manufacturing capacity and capability and adherence to environmental and CSR policies etcetera. To sum up, by moving towards asset-lite supply chains by the means of outsourcing, a number of crucial matters need to be considered during supplier evaluation. Among others matters regarding information technology, manufacturing strategy and various risks that should be taken into consideration.

Summary of mega trends

The mega trends indicate that a company's long-term competitiveness is substantially affected by the attributes of the supplier base. They also point in the direction of an increased degree of partnerships. The supplier base can provide possibilities as well as be an obstructive source in developing a company's business. It is therefore important to have a clear view of what competences the supplier base comprehends and to evaluate their possible future contribution.

MARKET TRENDS

In addition to the mega trends already mentioned, also a number of trends originated from customer's demands have been identified. The chapter presents these trends and implications that these might have on a company's supply situation are elaborated upon. The trends are short product life cycles and more unpredictable demand, increased customization and, the interest for corporate social responsibility (CSR). The market trends are important since they possibly have a significant impact on customer demand, thus directly affecting revenue and profit.

Shorter Product Life Cycles and more unpredictable demand

Product life cycles are becoming shorter (Christopher, 2010; van Hoek & Chapman, 2006), resulting in the necessity of a short time to market (TTM) for a number of products, such as medicine (Liu, 2009), cell phones and televisions (van Weele, 2009; van Hoek & Chapman, 2006). For instance the use of cross-functional teams and concurrent methods have proven to be useful in decreasing TTM regarding the product development process itself (van Weele, 2009) as well as for setting up efficient and effective logistics solutions (Zacharia & Mentzer, 2007; Khan & Creazza, 2009). By reaching a short TTM for new products and important product improvements, a company's products and technologies may reach the market ahead of the competitors'. This time advantage provides several beneficial conditions, for instance higher margins are possible to obtain and lock-in effects can be created (Lieberman & Montgomery, 1988). Also the company can develop a trademark which stands for developing innovative, market leading products. Another challenge facing companies is that customers' demand have become more volatile

(Christopher, 2011) along with competitors' product introductions making life-cycle demand hard to assess (Christopher & Lee, 2004), both contributing to a more unpredictable demand. By improving the agility of a company it may be more responsive to changes in demand regarding volume and variety (Christopher, 2011). An important prerequisite for becoming agile is to create partnerships with suppliers and align common processes across the supply chain, e.g. through information sharing and collaborative work (ibid.).

To summarize, lead times are of great importance and means to decrease them comprehend collaborative and concurrent work with suppliers, with which partnerships at some level should be developed. Therefore an assessment model of suppliers, would benefit from taking into consideration the possibility of building stronger relationships than just a transactional one.

Increased customization

Customers appreciate the possibility to tailor their products to become more personal and individually adapted, which has caused product differentiation to be important in order to stay competitive (Gunasekaran et al., 2001). Product differentiation can for instance be obtained by offering a wide variety of colors, materials and features that can be chosen and combined independently. In the automotive industry this could be exemplified by being able to choose from a variety of exterior and interior colors, materials for seats and different rims without one choice affecting another one, thus providing a great freedom to customize the product. A strategy for attaining product differentiation is postponement, which enables a company to postpone differentiation until forecasts are clearer or in fact actual customer demand is known (Christopher, 2011). The possibility of postponement is dependent on both the product design as well as the supply chain design (ibid.). Pero et al. (2010) mention another differentiation strategy, modular product design, in which a product is built by combining different interchangeable modules. Decisions regarding modularity are primarily taken during the product development process, but have a substantial impact on supply chain operations (Pero et al., 2010). Differentiation of a product can also be obtained by customer service, which have a wide range of applications from on time delivery to after sales support and other means which enhance the value to the customer without altering the physical attributes of the product itself (Christopher, 2011).

In conclusion a customization strategy is dependent on members both upstream and downstream the supply chain in order to be efficient. A closer cooperation upstream is desirable in the case of adopting any of the manufacturing differentiation strategies mentioned since the suppliers may have to deliver components in sequence with that of the assembling plant. For operations to run smoothly the implementation of EDI and other communication paths may be appropriate. A closer cooperation downstream is desirable if customer service as discussed should be held at a high level, for instance in order to secure on time deliveries and swift service repairs. An assessment model of suppliers would hence benefit from taking into consideration the possibility of developing closer relationships and capabilities of adhering to the company's chosen differentiation strategies.

Interest for Corporate Social Responsibility

Christopher (2010) and van Weele (2009) both have recognized that customers have become increasingly concerned with the social and environmental impact that their purchasing decisions have. This goes for both private consumers and professional purchasers. For the latter the concern is also a matter of decreasing business risk since suppliers can lie behind mistakes inflicting great harm both

financially as well as on the company's trademark. This matter often is exemplified by a case where the toy manufacturer Mattel had to recall toys which had been painted with paint containing lead (Gilbert & Wisner, 2010). It turned out that a subcontractor had used paint which wasn't approved, generating great harm to Mattel but possibly also to customers and plant operators (ibid.).

CSR at Mölnlycke Health Care

The supplier evaluation conducted at Mölnlycke Health Care covers among other things environmental and ethical concerns. For instance the supplier must meet the standards of Mölnlycke Health Care's Code of Conduct in order to qualify as a supplier. However, if a possible supplier doesn't live up to this standard but is appropriate otherwise; the supplier will not be dismissed without a discussion regarding any issues of concern. If the supplier can present a viable solution to reach up to the standards demanded by Mölnlycke Health Care, an action plan will formulated which will be followed up to secure that the agreed terms and conditions are met.

Mölnlycke Health Care has an ISO14001 certificate which shows that the company has an environmental management system. Also the company's website is utilized to show examples of how the environmental impact has been reduced by different actions as a way to promote environmentally friendly achievements.

The increasing concern with social and environmental issues and the fact that environmental regulations, regarding e.g. emissions and pollution are becoming more strict causes companies to form policies for corporate social responsibility (CSR) comprehending environmental and ethical issues. Compliance with a company's CSR policy will serve as a supplier qualifier, thus making this issue imperative for suppliers to adhere to, which is shown by the case presented above. As the importance of CSR is given great weight, an assessment model of suppliers needs to take into consideration not only how well suppliers can live up to the policies set by the company, but also how they can contribute to developing the policies further.

Summary of market trends

The market trends highlight a number of important aspects concerning the supplier base, for instance possibilities for inter-company integration and the prospects of adhering to various manufacturing strategies. An issue connected to the latter is how the supplier base can contribute to a company's agility. All these trends indicate the supplier relationships will become increasingly important and that the supplier base is important to bond with in order to maintain competitiveness. In addition, having active relationships with the members of the supplier base can act as a measure to mitigate various risks since one gets to know people better in the suppliers' organizations and how they operate.

BUSINESS TRENDS

Now some of the business trends that have been present during the 90's and 00's are presented. These trends have in one way or another affected the supplier base and/or the supply base structure as we can observe it today. The first trend described is the core competency concept which has increased the complexity of the supply chain, the increased complexity requires more in depth understanding of different risks and its implications on the supply base and is subsequently described. As has been discussed previously the strategic importance of purchasing has increased and is now found at a higher level in most companies but purchasing is still under influence of the company´s manufacturing strategy. Finally the

concept of servitization is presented which has further increased the importance of managing the supply base/structure.

The focus on core competence

As described in Chapter 1 outsourcing of internal activities to external partners has increased throughout the 20th century and as a consequence of this process the complexity of the supply base has increased. The reason for outsourcing has mainly been connected to that it is cheaper to let another company handle some of the activities than keeping them in-house. By the late 80's it was becoming evident that it was increasingly important to know what should be outsourced and what should not (Prahalad & Hamel, 1990). In order to know what activities to outsource and what activities to keep in-house the article by Prahalad and Hamel (1990) suggest the focus and understanding of the company´s core competencies; this is connected to the resource based view of the firm. As such companies today have become a lot more specialized, and often have a narrow area of expertise. In order to increase profits a company is likely to differentiate itself from competitors by trying to sell a service instead of a product (Robinson et al., 2002) like the company Rolls Royce that instead of selling airplane engines provides the service of flying hours (Howells, 2000).

But why not just make all the activities into core competencies? Since then the complexity would not increase and at the same time the share of the profit would be greater. Simply put it is due to that it is difficult for one company to perform many different activities efficiently. Why? It is a matter of available resources and the fact that different activities require different focus (Javidan, 1998). And while large companies might have the resources available they do not have the possibility to split their focus on many different activities, and actually there can be activities that are in conflict with each other (ibid.) which leads to difficulties in performing these activities efficiently. This means that a smaller company that only has two-five different core competencies can outperform a larger company who tries to have ten plus core competencies simply due to that the smaller company can much more easily focus its resources. So companies need to focus on a handful of core competencies in order for their business to be sustainable in the long term. Identifying relevant core competencies for the company requires an in depth understanding of the own companies activities and how they relate to the market they are aiming at (Javidan, 1998). Of course companies can not only perform the core competencies, a business needs many complementary activities in order for it to function properly. But activities that the suppliers can perform more efficiently while at the same time do not endanger the core competencies should, and are being outsourced. It should be noted that outsourcing activities that are not core competencies is not only done to low cost countries. The car industry is a great example of this where multiple suppliers to the production are situated within minutes or hours away from the manufacturing units.

The business strategy must always be in line with the core competencies of a company in order to reap the full benefits. It is possible for them to clash sometimes but if this is the case the company runs a great risk of losing out on opportunities and might even be exposed to situations where they no longer have full control over their core competence (Javidan, 1998). An example of how the focus on core competencies has affected an entire business sector is the car industry. From the beginning of the 20th century when the Ford Motor Company owned more or less the entire value chain needed to produce a car, from raw materials to finished car, to today's major car manufactures who mainly focus on two core competencies. (1) The assembly of cars and (2) the design of new cars (von Corswant & Peter, 2002). These companies

of course perform a multitude of different activities but these two will always be stated as something they are focusing a lot of their attention on.

The idea of core competencies was most heavily discussed during the 90's and has not been promoted in the same manner during the 00's. However the sourcing decisions made with core competencies in mind have influenced the supplier structure as we see it today. At the same time the decisions are not irreversible as can be illustrated by the fact that Volvo Powertrain is now discussing to perform the assembly of medium duty engines at their own facilities.

What implications can be drawn from the focus on one's core competencies then? That the number of suppliers for a company tends to increase, since they are performing fewer activities in-house. At the same time research has shown that suppliers have merged, resulting in just a few dominant suppliers for some components, which can be observed in the car industry (von Corswant & Peter, 2002). This further increases the importance of managing the supplier relationships. While the suppliers are dependent on the buying companies, the specialization and core competence focus has progressed so far that in many cases the dependence is more or less mutual. This dependence has led to suppliers becoming earlier involved in the product development process, which is (1) to ensure that a component/product is not designed so that the suppliers will not able to produce it and (2) to take part of the suppliers' component/product expertise. This in turn would mean that an evaluation model that could clarify what type of relationship the company should have with one supplier would be of great use. It would also be beneficial to see the degree of interdependence that would arise from choosing one supplier over another.

The need to understand risk

The increased complexity of the supply chains has increased the importance of evaluating and understanding risk in purchasing and a lot of research has been put into this area from the late 90's/early 00's (Harland et al., 2003). Risk is a very broad topic for industries and in order to get an overview risks are often categorized. Harland et al. (2003) presents such a categorization which is reproduced in

Table 8 Different types of risk

Type of risk	Risks that
Strategic risk	Affect the implementation of business strategies
Operation risk	Affect the company's ability to produce goods or perform services
Supply risk	Affect the flow of components needed to perform an operation
Customer risk	Affect the likelihood of customer purchasing goods/services from the company
Asset impairment risk	Reduce utilization of an asset
Competitive risk	Affect the ability to differentiate a company from its competitors
Reputation risk	Erode the value of a business due to lack of confidence
Financial risk	Potential losses due to financial market changes
Fiscal risk	Arise through changes in taxation
Regulatory risk	Arise through changes in regulations that effects the business segment
Legal risk	Arise from suppliers, customers or governments taking legal action against the company

The risks presented in Table 8 are all relevant to take into account when deciding which supplier to use, thus it is not interesting to rank one risk as more important than the other since it will depend on the current situation of the company and the supplier. So when discussing risk, care has to be taken as to what risk that is being addressed at the moment, otherwise it is very likely that confusion will arise. Further when assessing one can typically ask two questions (Harland et al., 2003):

- 1. How likely is it that an event will occur?
- 2. What is the significance or consequence if the risk occurs?

Further both question 1 and 2 can be divided into two parts, where in question 1 consists of the extent to which the company is exposed to the risk, the degree can vary, and what it is that can trigger the risk. Question 2 consists of the accuracy in predicting the consequence is connected to the regulations and laws that are in place, and it is also combined with the reputation of the company (Harland et al., 2003). A well known company is more likely to suffer more from a consequence then a less known (ibid.).

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In the aspect of supplier relationships risk is a topic that has gained ever increasing attention from companies due to the increased outsourcing activities of companies that has increased the complexity (Harland et al., 2003). When companies had most of their activities in-house and mostly sourced locally, risk was easier to assess and handle since the company would have an overview of what consequence a decision would have (ibid.). The increased complexity with multiple tiers of suppliers increases the difficulty of perceiving risks and hence companies have to put more energy and more resources into identifying risks. It is impossible to hedge against all the risks that a company could be subjected to. It is rather a choice between what risks the company is willing to be subjected to and what risks it does not want to take. An example of this is the different sourcing strategies described in Chapter 1; the single sourcing strategy could reduce the risk of missing out on new innovations, especially in mature and highly competitive supplier markets, since the company should be more important to the supplier, but the company is then exposed to the risk of what happens if the supplier does not deliver what is promised. The multiple sourcing strategy on the other hand reduces the risk of being out of supply, at the same time the company is less important to the supplier and may share innovations with the competitors first which means that the company is missing out on opportunities.

Different perceptions of risk

That different companies in different industries would handle risk differently and that they guard against different sorts of risks is almost a given, but it is very illustrative of the fact that risks will always be present. Volvo Powertrain has put substantial efforts into reducing their supplier base so that they today have 84 key suppliers. Volvo Powertrain is aware of the risk that they are subjected to by using a single source strategy but they believe that by focusing on a few suppliers they can become a preferred customer. To Volvo Powertrain this means that if anything happens with the supplier, such as productions issues, the supplier will immediately inform about it and that Volvo Powertrain is first in line to receive goods once production is back on track..

Skanska´s supplier base is completely different from Volvo Powertrain's and in the Nordic region alone Skanska have over 50 000 different suppliers. The number of suppliers is due to the building industry where there are a lot of small independent companies. Skanska is now putting efforts into reducing this huge supplier base; this is due to that the company wants to have a better control of who their suppliers are. One of the aspects is to control the ethical compliance which is one of the five zeros.

The Wound Care division at Mölnlycke Health Care is in yet another situation, their market is still very innovative meaning that new technologies or innovations can mean a substantial advantage over competitors. Since Mölnlycke Health Care's purchasing power in terms of volume in some instances is quite small this means that there is little possibility to influence their suppliers in this manner. In order to reduce the risk of this happening the company puts a lot of focus into managing their relationships.

These three cases illustrate that risk is ever present in all companies. Further what one company perceives as a risk to guard against another might see as an opportunity for gaining competitive advantage. The cases also illustrate a tendency in that companies are increasing the cooperation with their suppliers and their supplier base. Volvo Powertrain mainly focuses on single sourcing, for at least its key suppliers, and though it is aware of the very real risk of not receiving the goods they need the company believes that the multiple sourcing presents an even greater risk. That if it uses multiple sourcing it will not be the first

to take part of innovations from their suppliers. Volvo Powertrain believes that by being first with new innovations on the market the company can gain a competitive advantage. For some of the critical components there exists only a few suppliers, such as the injection system case described in Chapter 2, and when competing with all the other car manufacturers it has to focus its attention on one of these suppliers to become a preferred customer. Further it should be noted that Volvo has production facilities across the globe and so do its suppliers meaning that materials/products could be sent from other parts of the world to cover a shortage. Skanska understands that by having such a large supplier base it is not only diluting its buying power, Skanska is the third largest contractor in the world, it also realizes that there is no way that it can control their suppliers. By reducing the supplier base it can more easily overview the supply base structure of tier 1 suppliers, tier 2 suppliers and so on. This reduction will also help Skanska in increasing their buying power. Mölnlycke Health Care's Wound Care division is still expanding its supplier base due to their innovative market and is constantly looking for new suppliers that provide new materials which Wound Care can use in its products, either by buying existing materials/components or by co-developing new materials/components. This often puts Mölnlycke Health Care in a position of dependence that is not always favorable and the volumes that they buy are sometimes small meaning that they take great care in evaluating their suppliers in relationship areas, to assure that innovations do not leek to the competition.

So companies have to be aware of what risks different decisions bring, and due to the increased volatility of the market companies have to be flexible enough to guard against different risks depending on changing conditions. A model that could incorporate risk assessment or different types of risk in its model could be beneficial in helping companies understand what risks are present in their supplier base; risks that result from their choice of sourcing strategies.

Production strategies affect purchasing

Traditionally in manufacturing companies purchasing has been completely controlled by the overall manufacturing strategy and not until recently purchasing has been regarded as something strategically important, but as outsourcing has increased over the last decades its importance has been acknowledged (Gadde et al., 2010). However the purchasing strategies are still strongly subjected to the utilized manufacturing strategy and these two in turn affect the structure of the supplier base. An example of how manufacturing strategies can affect purchasing is now presented.

Lean production - Lean purchasing?

The Toyota production system (TPS), or Lean production, is a well known production philosophy that focuses on reducing waste in a company (Liker, 2004). In the TPS the concept of just-in-time (JIT) is introduced for a production plant. JIT basically means that products/components should be at the right place in the correct amount at the right time. JIT gives rise to the need of a purchasing strategy that is in line with this type of production strategy, subsequently the term JIT purchasing has been coined. JIT supplier relationships are typically built on high degrees of mutual trust and openness between the supplier and the company (Skjøtt-Larsen et al., 2007). In order for JIT to work well in a purchasing organization, the demand on the suppliers has to be fairly stable, otherwise the stocks will just be pushed upstream and the suppliers will put the price for storage on the component/product. This defeats one of the purposes of JIT and typically occurs when too much focus is put on implementing TPS philosophy in the production plant without any regard to how this affects the rest of the company or supply chain, this will lead to sub-optimizations and a great advantage with TPS is lost (Liker, 2004). Since JIT requires a higher degree of

involvement and relationship management to function efficiently the supplier base, at least the part that comprehend the JIT suppliers, should be quite small and further these suppliers should be thought of as long-term partners (Skjøtt-Larsen et al., 2007).

The implication of JIT purchasing is most likely that the supplier base is reduced since these relationships require more time and resources which make it difficult to manage with a large supplier base. The use of JIT also increases the importance of the suppliers since if issues arise at their production, the information has to travel quickly to the buying company since they need to be aware of the issue as fast as possible. This implies a much tighter cooperation between supplier and buyer.

So the manufacturing strategy the company has will affect the relationships with suppliers and different strategies will most likely require different relationships. This means that a model that takes into account the own manufacturing strategy could be a helpful tool when evaluating the supplier base.

Servitization of products

Servitization is a concept that has gained attention from the late 90's/early 00's. The idea behind the concept is that in order for a manufacturing company to stay profitable they have to do more than sell products they have to provide services connected to the products (Slack, 2005). These services can include maintenance, storage, IT support and much more. Studies imply that servitization is especially beneficial for companies that already have a large base of products out on the market and the services that are to be used are less sensitive to economical downturns, meaning that companies can keep up revenue even when times are tough (ibid.). The servitization concept can be split into stretch and width. Stretch means that a company will move down the supply chain to handle services that have previously been performed by other actors like maintenance. Width means the number of different services that the company offers its customers (ibid.). This concept leads to that a company will have to have a tighter cooperation with their suppliers in order to be able to offer different types of services at an acceptable level for the customer.

Summary of business trends

The business trends from the 90's and 00's that are described, all point towards the need for greater cooperation between the buying company and the supplier. How this should be achieved is not completely clear and the different trends are not completely in line with each other. On one hand trends like risk and servitization seem to focus more on the need to manage the supplier base/structure, maybe by being the one in control. Though this may not always be possible, on the other the trends of core competence and of manufacturing strategies seem to promote the idea of working together with the suppliers to achieve maximum benefit. The difference could simply be put to that assessing risk and deciding degree of servitization is more of an internal matter which means that the company should be in control, whereas core competency decisions and manufacturing strategies affect the suppliers in higher degrees and it is therefore more natural to think of cooperation.

CHAPTER 4

THE SUPPLY NETWORK MODEL

This chapter starts by deriving the need for a network perspective based on the literature review and company examples in the previous chapters. Based on the discussion a new purchasing model is introduced. While Kraljic's focus was on exploiting one's negotiation power and the successors emphasized the importance of valuable relationships, the new purchasing model, the Supply Network Model, move on to a network focus.

THE NEED FOR A NETWORK PERSPECTIVE

Strategic sourcing is an important part of today's business. Yet the development of supply base strategies, development of portfolio matrices, and implications of trends on supply base structuring has further increased its importance and implies that there is a need for a network perspective.

Why strategic sourcing is of importance

Businesses continuously have to strive towards improving performance measures such as cost and lead-time reduction in order to secure competitiveness and long-term prosperity. More intangible performance measures such as customer satisfaction and various skills are also important since they affect business performance as well. In addition capabilities are of great importance to develop, for instance capabilities for manufacturing certain materials and products, i.e. process capability. Also capabilities in terms of adopting new technologies and solutions have to be developed. By ensuring such capabilities customer demand in terms of new products, technologies and services can be met.

Altogether the situation pictured here poses a great challenge for any business, regardless of size or industry. An obvious question to ask is then; how shall this challenge be undertaken in an economically rational way? The answer often is; by sourcing. For good reasons as well. Sourcing of components can be a means to reduce fixed costs as mentioned in Chapter 3 and can also be a way of securing capacity during demand surges. By sourcing components, which demand a manufacturing process that is technology intense and/or with a high cost barrier, to a specialized partner a business can enjoy the benefits of economies of scale even a low production volumes. Sourcing components can also be a means to secure capability, which also is a reason for why product development in some instances is carried out by a company's suppliers. Yet another reason for sourcing activities is that it makes it easier for a company to focus on what is seen as core competency, also as mentioned in Chapter 3.

Thus there are a number of reasons for why suppliers are given the responsibility for providing material and intelligence. In conjunction with the identified trends presented in Chapter 3 as well as the presented case descriptions it is clear that businesses to a large extent are reliant on external business partners. This leads to the conclusion that sourcing and the supplier network are of great importance and therefore supply network management is a key to business success.

Development of supply base strategies

Today more than ever companies depend on their increasingly complex supply base and for that purchasing has become an important strategic function. The cases have provided some insight to how purchasing is handled within Skanska, Volvo Powertrain and Mölnlycke Health Care and it can be concluded that the companies have reached different levels of maturity in its sourcing activities. This has its explanation in that the companies are operating in different industries and therefore faces different challenges. We have seen that Skanska is reducing variety by reducing its supplier base, Volvo Powertrain is increasing complexity to gain more benefits and Mölnlycke Health Care's Wound Care division is exploiting heterogeneity too greatly increase the value of its products. Hence, with limited resources and a dynamic market environment, challenges should be formed to best reduce costs and gain opportunities. Pure single or multiple sourcing strategies are therefore not sufficient in today's business environment, but variants of them are most often used such as dual, parallel or single group etcetera. However, not even these variants cover the full picture of the supply base and the handling of it. While companies are

generally reducing their supply base, according to Christopher (2010) there is an uncertainty of how to develop the relationship with the remaining suppliers.

What is also increasing the complexity of the supply base is that suppliers are developing relationships with other suppliers, for example by dyadic sourcing or triadic sourcing. This highlights the need to not only incorporate the tier 1 and 2 suppliers in managing the supply base, as there might be interdependencies and collaborations between different tier levels. Further in this book the supply base is defined as the collection of all suppliers the buying firm is doing business with, from tier 1 to tier n suppliers. This definition goes in line with creating win-win relationships, which all relationships in the supply base needs to be so that everybody wins in the end. What is needed is hence, a network perspective on the supply base, incorporating tier 1 all the way to tier n and all the suppliers within each tier.

Development of matrices

The portfolio matrix models have changed over time. By highlighting the importance of the purchasing focus the portfolio matrix model Kraljic (1983) had a great importance. Many organizations are influenced by the Kraljic thinking, but how the supply chain is assumed to be managed in the best way has changed over time. Kraljic had a product focus aiming to exploit maximum buying power. The more modern portfolio models such as Olsen and Ellram (1997), Bensaou (1999), and Gelderman (2003) presented in Chapter 2 have adapted the thinking of the portfolio matrix model to a relationship perspective which was in focus during the 90's and 00's. However, since the relationship perspective nowadays tend to be developed into a network perspective the portfolio matrix models have to be developed in order to be applicable in the environment of today. Dubois and Pedersen (2002) argue that a network perspective is important because you can "capture network potentials and thus increase the contribution of the purchasing function". Becoming aware and capitalizing on the potentials from not only the tier 1 suppliers but from the whole network can provide the buying company with more benefits than interacting with the tier 1 suppliers only.

Implications drawn from the trends

The main implication of the trends that have been presented in Chapter 3 is that relationships between buyer and supplier have increased in importance and that tighter cooperation is needed in order for the strategies that have been developed during the 90's and 00's in order for the overall business goals to be achieved. The interviewed companies strengthen this assumption since they have all increased focus on relationship management. However the trends are not in complete unison as different trends, although they all point towards tighter cooperation, focus on different ways of managing the relationship.

The increased importance of risk management, the pressure of corporate social responsibility, and servitization of products can be said to promote the idea of being in control of the relationship, although this may not always be possible due to differences in power between the supplier and buyer. They do none the less point to the increased importance of relationship management. The trends of reduced access to materials, oil, and capital with the trends of increased specialization (focus on core competence), increased customization, reduced time to market (TTM), and used manufacturing strategy on the other hand put focus on mutual influence of the different actors.

The differences in the perception of how relationships should be managed can be connected to that the trends that promote control of relationships often stem from internal decisions or functions in the company. For instance what risks are acceptable and those that are not acceptable, while those that focus

on the mutual control are more external of decisions/functions. Regardless of perception it is evident that relationships and relationship management have gained an increased importance. Therefore it is desirable that a tool for evaluating and developing one's network incorporates the relationship aspect of today´s businesses. As a consequence of this increased relationship management the costs in this area will typically increase, as such the network approach is a logical step since in a well functioning network different links can have contact with each other and the cost for maintain the relationships can be spread among the network actors instead of everything being handled by one actor.

THE SUPPLY NETWORK MODEL

The development of supply base strategies and matrices as well as the implication of trends on supply base structuring all implies that there is a growing need to look at the supply base through a network perspective. Therefore the authors of this book have developed the Supply Network Model which can be used by companies to analyze and develop its supply network. The model can either be seen as a next step in the strategic sourcing process for companies that have worked through the six issues described in Chapter 1, number of suppliers, reducing the number of suppliers, relationships between the buyer and the suppliers, how suppliers are organized, how relationships change over time and management of supply performance. However, it can also be used by a company in the beginning of strategizing its supply base structure. The Supply Network Model consists of the five steps; map, evaluate, match, develop and improve, see Figure 14.

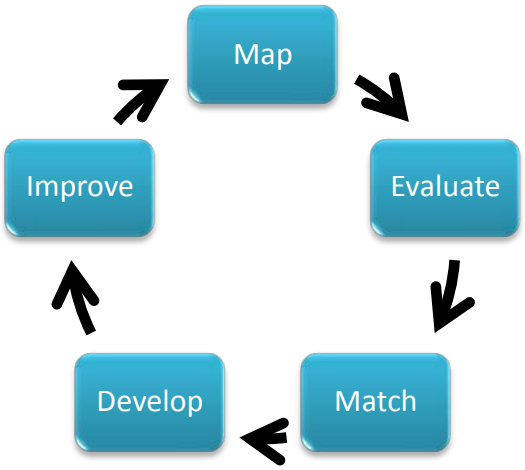

Figure 14. The Supply Network Model

The first step of the model is to map the resource ties, actor bonds and activity links in the current network. This mapping will be the input to the next step where the network is evaluated based on the level of horizontal and vertical integration of supplier relationships, in the Supply Network Matrix Model. Depending on the level of integration different supply base strategies are presented. Then a match should be made between what the company believes that the network should provide and what it actually does. Some link, and/or vertical, should be more or less integrated, if the network is not at all able to provide what is needed a new network should be identified and last, unnecessary links should be removed. After this identification the forth step is to develop the links that are required to form the new network. Last this process should be performed with regular intervals to constantly improve the supply base network.

As seen in Figure 14 the model is illustrated as a wheel. Because companies are operating in a dynamic environment it is important to see the network improvement as a continuous process. The demand for products is known to follow a product life cycle curve, see Figure 6 in Chapter 1. The supplier relationship

needs to evolve correspondingly; since the demand increases rapidly in the beginning, there is a need for a close relationship with the supplier in order to secure supply and to avoid bullwhip effects in the supply chain. As the demand for the product matures the need for a stable supply emerges and focus moves from a close collaboration to a more cost efficient collaboration. If the demand for the product slowly dies, so does the need for a relationship with the supplier. This illustrates the need for a continuous review of the supply base strategy, since the conditions for the supply network constantly change. But often when a buyer and supplier engage in a relationship, other products or services are developed as well during the early stages of the product's life cycle. Therefore a relationship is mainly not steered by the one product but can live on for many products and/or services and also vary in intensity depending on the level of innovations that comes out of the collaboration, and where in the life cycle the products are.

Another aspect regarding the need for an iterating process is the purchasing department's maturity; see Figure 5 in Chapter 1. The maturity of the purchasing department affects the possibility of close and collaborative relationships with the suppliers, as well as the choice of a supply base strategy. If the purchasing department is mature and hence professional in their actions regarding supply base strategies there is a possibility for the department to pursue advanced strategies in order to handle the supply base. But if the purchasing department is not mature, it is rather a question of where the network needs to go in order to develop the links and resources the company is lacking. If there is a need for increased specialization and product development, the company should try to focus on the horizontal development of their network. If instead a reduction of handling complexity and increased tier system collaboration is desired, the network should be developed vertically. Since the maturity of the purchasing department could develop over time, this stresses the need for an iterative process, since the company is in different needs of the Supply Network Model depending on how mature the purchasing department is.

The model will hence aid companies in analyzing and developing its supply network, incorporating tier 1 suppliers all the way to tier *n* suppliers, and suppliers within tier 1 mainly. Each step will be described in depth in the sections to follow.

Map

In order for a company to know how to relate to its network, it is important to know where the strengths of the network lie. Therefore step one in the Supply Network Model is *Map*. If the need for change or development only concerns part of the network or certain functions, it is sufficient to map only those parts of the network. In order to map the network or part of it, which could be a large and complex assignment, the use of the Activities, Resources and Actors (ARA) model developed by (Gadde et al., 2010) could facilitate the assignment. This model describes a company's assets by dividing them into the three network layers Activities, Resources and Actors, although they are interconnected and thus still affect each other (ibid.). The three layers include what *resource ties, actor bonds and activity* links that exist in the network. A central issue when it comes to the resource layer is how to combine resources. All resources can be combined and recombined in many ways. One of the mentioned trends in Chapter 3, outsourcing, for example provides the buying firm with the resources of other firms. Combining resources can be done in several ways. It can be done internally or externally, it can combine existing resources with new ones or by recombining existing ones (ibid.). A description of resources is presented below:

1. The resource's value depends on how it is connected to other resources
2. A resource is not static but can change over time
3. A resource is connected to a multidimensional context
4. The change of a resource will create tensions
5. The effects of a change in a resource is intensified by interaction
6. If the interaction has breadth, it affects the number of resources affected by a resource change (Håkansson et al., 2009)

The *activity links* are concerned with the physical flow. There is a need to decide what activities are needed in the network, what actor should manage what activities and how the activities should be structured. The activity structure can be connected to three issues; interdependence, continuity and diversity (Gadde et al., 2010). Continuity can be obtained by the purchasing department securing supply by long-term relationships with the suppliers. Interdependence among activities that are crossing company borders can be managed by synchronizing the physical flows. Finally diversity is required by the demand side and puts pressure on the purchasing department to provide a wide assortment of products that can be combined in different manners without causing higher costs (ibid.). The *actor layer* is the layer where the resources and activities are managed. The changes made in the resource and activity layer eventually affects the actor layer (ibid.). The actors should act in collaboration with the suppliers for important changes in order to succeed (ibid.).

A link in the network could be a physical transportation as well as sharing of information. A node could be a warehouse or a production plant. If one link or node is moved in a network, it likely affects the other links and nodes in the network as well (ibid.). Therefore it is important to know how to handle the network and what effects changes can have. It is important to note that it is necessary to facilitate the making of the ARA model since for a large company, the assignment otherwise could become too complex and time consuming. When the assets of the network are mapped in Resource ties, Actor bonds and Activity links the company can move on to evaluating them in order to find out how advanced their network is.

Evaluate the supply network

When a company has mapped its supply network it should evaluate the network in order to specify the characteristics of the network. The network can be structured in several different ways, actually one network does not look like another. However, when evaluating the network it might be useful to use some kind of portfolio model in order to define what kind of network structure the focal company has. Due to the complexity of supply networks it might be good to focus on an isolated part of the network. Therefore the Supply Network Matrix Model (SNMM) is developed; it contains in similarity to Kraljic's portfolio model four quadrants with categories and two input axes, see Figure 15. At the first catch of an eye the picture looks almost the same, however, it is just the shape that is in common. The input axes are labeled as *horizontal and vertical integration* in the supply network. The four quadrants represent four different kinds of network integration. The output from the model is to what extent information sharing and interaction take place overall in the supply network. By developing this model the portfolio matrix model's focus is developed from the product and relationship focus presented in Chapter 2 to a network focus.

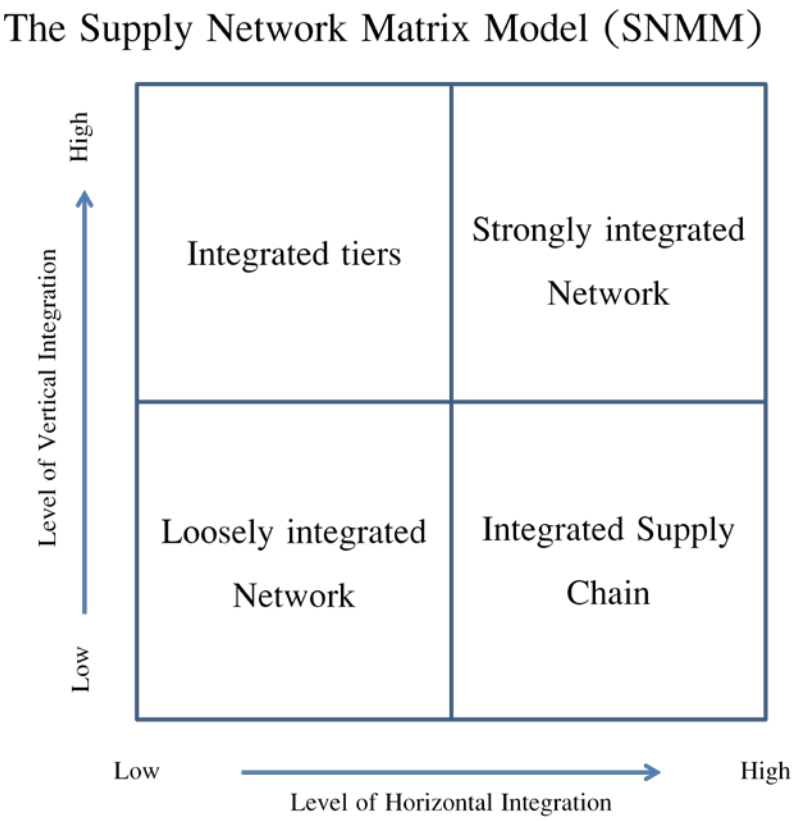

Figure 15. The Supply Network Matrix Model

The Input to the matrix

The interrelationships in a network are evaluated by assessing two different parameters. The first one is the *level of vertical integration* evaluate the information sharing in the supply chain. The integration of supply chains is actually two dimensional; (1) In order to create efficient supply chains information sharing is necessary. There are several articles and books highlighting the importance of information sharing in order to create efficient supply chains and reduce the bullwhip effect (Lee et al., 1997). One way of reducing the forecasting uncertainty and the bullwhip effect is to share information directly through the entire supply chain. The information in focus is mainly related to activities, e.g. sales data, manufacturing schedules etcetera. (2) The integration is not only about information sharing it is also affected by the intensity of the relation, i.e. to what extent the parties cooperate. Some companies only get the data, the transparency between actors give the focal company insights to the different tiers and actors. However, it might be other companies that have connected the research and development (R&D) departments to each other in order to collaborate in the product development process, it is also possible to connect production departments in order to share production systems and get an optimized production flow through the entire supply chain. Both examples have a high level of involvement according to information sharing in several tiers, but the intensity in the relationships and links vary. In some companies the border between different actors in a supply chain is very clear and as little information as possible is shared.

The second dimension corresponds to the *level of vertical integration,* which concerns how the suppliers in a certain tier interact with each other. Due to the different trends described in Chapter 3 companies often are dependent on each other in order to come up with innovations and create solutions that make it

possible for the company to fulfill its business idea. This parameter describe how viable the links between companies are and to what extent they share resources and actors in order to come up with a solution. These kinds of links are for instance important if two subcontractors are supposed to deliver two different modules to the focal company, but the modules are interdependent. If there are no connections between the subcontractors all communication has to go through the focal company and the information will therefore be delayed and there is a risk that important information disappear due to several steps of information transfers. If all subcontractors in each certain tier are linked to another subcontractor the level is close to maximum. If no relationship links exist between any subcontractors it the level is at the minimum.

The four quadrants in the network model

Depending on how high/low the levels of integration are, the supply network will be categorized into four different categories

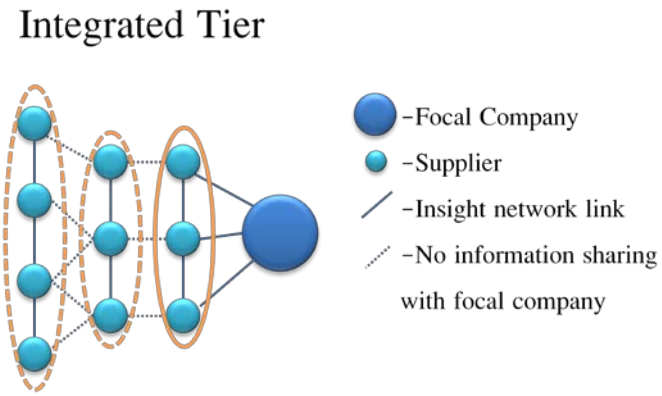

Figure 16. Cooperating subcontractors network

In the upper left quadrant is the (1) *Cooperating Subcontractors Network.* According to Figure 15 the levels of vertical integration is high, while the level of horizontal integration is low, see Figure 16. In this network the subcontractors is collaborating in order to avoid sub optimizations for the focal company. The links between suppliers in a certain tier is probably most important in that case the suppliers are involved in the R&D phase, due to that a change at one supplier might affect the interface and possibilities for another.

In the upper right quadrant is the (2) *Strongly Integrated Networks,* in this quadrant the focal company has insight in the entire network; both in vertical and horizontal links, see Figure 17. These kinds of networks are used when the products have a complex component structure. Suppliers in the tiers have to cooperate in order to adjust different solutions to fit together and the supply chains have to be frequently updated with information in order to secure the horizontal supply. A feeling might occur that this network is the optimum one to be a part of. However, information sharing and relationship maintenance are quite complex to arrange and success with; the strongly integrated network will be a costly arrangement. Therefore, the companies need to balance cost and value. Another drawback of strong network connections is that it will be more static and more difficult to rearrange the supply network setup due to the large investments that are put into the network from all parties. If a company is too locked into a network there is a risk of not recognizing new technical paradigms and being left behind when the

competitors launch new innovative products. Therefore, not all networks should be of a strong network character.

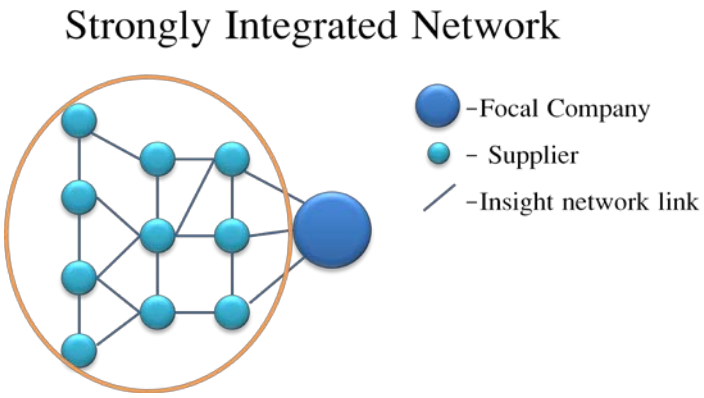

Figure 17. Strongly Integrated Network

In the lower left quadrant of Figure 15 the (3) *Loosely Integrated Network* is located. In this setup the focal company only share information and have direct relations to the tier 1 suppliers, see Figure 18. Due to low involvement the network links are weak and the actors of the network is probably changing over time. The products sourced by the focal company have to be simple and the suppliers are not involved in the product development (PD). The tier 2 suppliers are not aware of the focal company's PD process and the focal company has neither any awareness of the PD process at the lower level tiers suppliers department. By this set up the insight in the physical flow of products and activities will be limited.

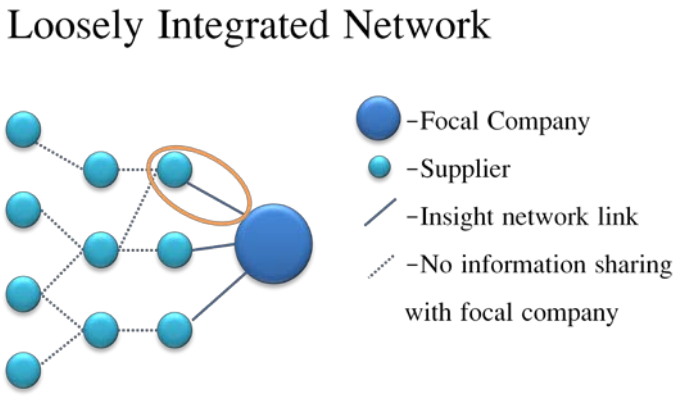

Figure 18. Loosely Integrated Network

The last quadrant, located in the lower right corner, represents the (4) V*iable Supply Chain Network*. In this kind of network the focal company has insight in each supply chain's activities. Information can be shared and suppliers can be involved in designing different processes that affect the activities in the chain. However, the suppliers in the same tier do not cooperate nor share information, see Figure 19. One situation when this works might be when the suppliers do subcontract work and the instructions and drawings are provided by the focal company and the single suppliers actually do not have to cooperate

vertically in order to deliver what is needed. The information sharing between tiers help the focal company and the entire supply chain to avoid sub optimizations.

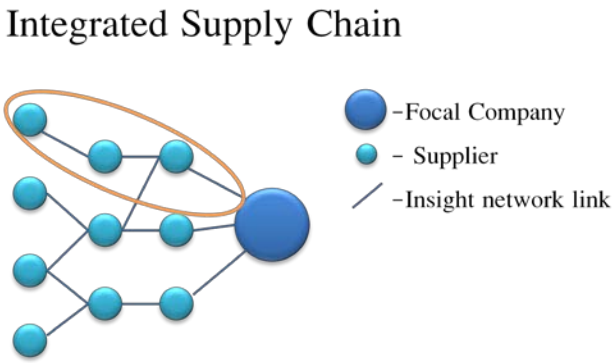

Figure 19. Integrated Supply Chain

Applicability of the Supply Network Matrix Model

As mentioned in the introduction of the *evaluate supply network section* the SNMM can be used in order to evaluate the network type in the current state. The model gives a brief explanation of what kind of network the focal company is an actor in and what consequences this might have. The SNMM can also be used in order to evaluate how a future state should look like. The network of today may not the most optimal in order to support the company to fulfilling its business idea. By using the SNMM the company can get an enhanced understanding for what kind of network it should try to be connected to. It is impossible for the focal company to change all the relations in the network, but by making active choices when connecting to nodes it is possible to get a more suitable structure than if the company has not made any analysis at all beyond tier 1.

Match the network

Once a company has evaluated where in its matrix the current network, that the company is connected to, lies they can start to see if this matches what they believe that the network should provide. It could very well be that a company needs a strong network, or at least believes it does, when it actually is in a loose network. To rearrange an existing network from a loose to a strong network may be a nearly impossible task, and unless the own company is a really strong (major) actor in the network it maybe should not be tried at all. Rather it might be time to look for other networks that could offer the characteristics that the company needs. This can of course not be achieved in a short period of time; it will require a conscious and well prepared plan before such a step should be taken. Also the company should not only try to find a new network which provides what the company needs, or change the current one to do so, it should also identify does parts that the company does not need.

If the network the company needs is not the network that the company is currently a part of, then they could follow the following method: (1) Before even considering switching to a new network, the first option should always be to see if there is a possibility to influence the network in any direction (more vertical or more horizontal integration), here a preliminary contact with the different actors could be a way to identify the possibilities of changing the current network. Depending on the complexity of the product, typically a high degree of complexity in a product means that there are a lot of different components or sub-systems, it might be prudent to focus on one or a few components or sub-systems at a time. Which

not only helps the company learn how to interact with its suppliers to attain the wanted effect, it should also increase the success rate since the company can focus its resources. Further there might be a need for different networks for different components/sub-systems

(2) If there is no possibility for the company to influence the network to change than new networks have to be identified. It should be noted that it might not exist networks that fit exactly what the company needs that it could join immediately. Instead they may have to try accessing networks that are of the two other types of networks and try to influence them into evolving towards the desired network. If this step is needed a couple of different networks should be identified so that if one network does not want to work in this manner the company can go onto the next. And as in step 1 the company should be looking for one or a few components/sub systems for which to switch network

(3) Regardless if the company has to perform step 2 or not, while influencing the network to change it should identify those parts that are no longer wanted/needed of the network and start phasing them out.

These three (or two) steps can be seen as the match for a company and is the preliminary round, these steps the company can perform on its own to get the change of the network started. To actually move the network from one square to another will require the next step in the process; *Develop the network*.

Develop the network

Once the company has chosen to either stay with the current network or decided to start working with a new network the task changes to start developing the links that will be required in order for the network to perform as is wanted, of course already exiting links can be used and developed or altered as needed, they do not have to be recreated. These links can vary in terms of strength as they can go from informal bonds to very tight bonds. It is important to get all the actors who are going to be a part of the new network structure onboard for the transformation process and they should all be made aware of what is going to happen, a brief explanation of how this could be performed is described below.

It could be that the current network is loose but an integrated supply chain has been identified as the needed network than the company should in each link start working with the relevant actors to start form stronger relationships than the current arms length type of relationships. This could be done by increasing the amount of information shared, such as point of sales data, in the link to provide for more efficient flows or by encouraging joint development of new products/components/materials.

This procedure would be more or less the same for integrated tiers and strong networks, though the latter case will require substantially more effort. Important here is that when developing links between actors, they should not only be formed between the actors that are closest to each other. In the integrated supply chain there could be a need for direct links between tier 1 suppliers and tier 2 suppliers, tier 1 suppliers and tier 3 suppliers and so on. And in the integrated tiers there could be more than one or two direct links between the suppliers in the same tier. But links should not be developed just for the sake of developing them, there has to be a value in creating a specific link in order to justify its creation.

This development is a long-term procedure and the actors involved should be assured that this is the case and that the completion of the new network structure takes more than a few months. The steps taken towards the new type of network should be small and incremental so that each step closer to the goal builds on the previous one, in this way every actor in the network will, hopefully, understand the change that is going on. Also in this way the actors can start setting up links with each other so that it is not only the initiating company that is responsible for the change

Improve

One aspect that can be found from the company interviews, and as can be seen in the Chapter 1-3, the world is ever changing and nothing is static. The network should therefore never be treated as static, and it will require constant maintenance in order for all the involved actors to gain the full benefit of the network. As such the process that is presented in this chapter should be performed within regular intervals, what was needed or important the first time might have decreased and other aspects may have increased. There should not be a need to switch network strategy completely but it might need some tweaking, if for example a network is an integrated tiers type, new emerging trends or competitors might require a shift towards a strong network or even a loose network. The important outtake is that an existing network structure might be the best one today however it may not be so tomorrow.

Applicability of the Supply Network Model

Different industry sectors, and different companies, purchasing departments are in different stages of maturity. This means that every company should not treat their network in the same manner. Therefore the Supply Network Model (SNM) can be applied independent of the industry sector that the company is operating in. Since regardless of which of the four quadrants the company identifies that it is currently a part of that it is not locked in the current quadrant forever and that the company has a possibility to change its current situation, and by using the SNM the company can plan and initiate a plan to change their network into the desired one. The interviewed companies are in widely different industry sectors and have a different degree of purchasing maturity which is to be expected.

Volvo Powertrain has worked at reducing the supplier base to 84 key suppliers and can be said to have a very high degree of horizontal integration in its supply base and as such has an integrated tier network. Volvo Powertrain should therefore consider starting to work on the vertical integration to increase the strength of its supplier network. The company has identified the most important need to be to take part of new innovations as a means to gain competitive advantage, and in order to foster innovations quickly in a mature market a strong type of network is to prefer.

Due to the large supplier base of Skanska it can currently be said to have a loose type of network. It may be preferable for Skanska to focus on increasing the horizontal integration of its supplier base to reach an integrated tier network since then it can increase its buying power contra its suppliers, something it has already done with the transport haulers which has been very successful. Further by doing this it will become more important for their suppliers and the company can therefore put harder regulations on them to act ethically, something that Skanska has identified as a key aspect.

Mölnlycke Health Care is likely to need two different supply base strategies, since the company deals with both mature and innovative markets. This leads to that one part of the supply base will fall into one quadrant of the Supply Network Matrix Model and the second part of the supply base will fall into another quadrant. The mature market could benefit from a strong network type whereas the innovative market maybe could benefit from an integrated tier network or integrated supply chain. The supply base for the innovative market maybe even would benefit from being in a loose network since this strategy facilitates easier identification of new innovations from other suppliers since they are not locked to their current suppliers.

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