Make or buy?
Developing a generic framework for make-or-buy decisions at Cardo AB

Martin Ekelund & Erik Pettersson
Supervisor at Linköping University: Björn Oskarsson
Supervisor at Cardo AB: Jonas Lundgren

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ABSTRACT

Cardo AB is an international corporate group that has performed major organizational changes the last few years. These changes utilize possible synergies that exist in a corporate group. One of the initiatives is that Cardo wants to develop a model for make-or-buy decisions. Therefore, the purpose of this thesis is stated as:

The study’s purpose is to develop a generic model for make-or-buy decisions at Cardo.

To develop the model, a theoretical study was conducted, where four main aspects were identified: core capability, risk, cost and relationship. For each aspect, a tool to define what the aspects consist of was identified. The aspects were combined together into a model, called model version 1. To enhance and adjust the model to suit Cardo’s situation, an empirical study was conducted. In the empirical study, it was investigated how different sites within Cardo are currently working with make-or-buy decisions. Moreover, in the empirical study it was also revealed how Cardo is dealing with each of the aspects identified in theory. The combination of theory and empirical study formed the enhanced model, called model version 2. The last step in the procedure was to let several end-users review the model and suggest improvements. After this step, the final model was formed, called model version 3.

The model combines the best practices from Cardo with the latest theoretical aspects. Using this model will help Cardo deal with make-or-buy decisions in a structured way. The model highlights the importance of connecting business strategy with the core capabilities of Cardo and provides a tool to identify this connection. Furthermore, the model highlights risks connected to outsourcing and provides tools to identify these risks. The model also applies a total cost approach. To calculate the different costs, a model is presented that functions as a guide when quantifying costs. Lastly, the model shows the importance of developing a proper relationship with the supplier according to the strategic importance of the product.
This master thesis is the last performance we do as students at the Institute of Technology at Linköping University. The work with the thesis has given us a wide knowledge in the topic of outsourcing and make-or-buy analysis. Also, experience of how work is performed in an international corporate group.

The thesis was performed at Cardo AB, where we have interacted with several persons that have been helpful for the outcome of the thesis. We want to show gratitude to: our supervisor Jonas Lundgren that has assisted us with recommendations of people to gather information from and guided us through the work. Our supervisor at Linköping’s University Björn Oskarsson and our opponents Caroline Johannesson and Jonas Hagelin that have been a great support for us when developing the model. All persons we have interviewed within Cardo have been very helpful and contributed to develop the model. In addition, Birgitta Nilsson that assisted us with all arrangements and made us feel welcomed in Cardo. We are also grateful for all suggestion for improvements that family and friends have given us.

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1 INTRODUCTION

In this chapter, the reader is introduced to the background of this master thesis that leads to the purpose of the thesis. The purpose is concretized and limitations plus directives are presented along with the scientific demands of the report. Lastly, the outline of the report is presented to give the reader an overview over the report.

1.1 BACKGROUND

In today’s global markets, companies have to be cost-efficient in their operations. Because of the global competition and the increase use of labor in low-cost countries, global competition is tougher than ever before. With this in mind, companies have to deliver their products on the global market at a low cost and with high levels of service to their customers.

Cardo AB, referred to as Cardo in the rest of the thesis, is a company operating on the global scene with headquarters in Malmö, Sweden. Cardo has approximately 6000 employees and total sales of almost 10 billion SEK. Cardo was originally an investment company, but since 2005 the company has been an industrial-group consisting of three divisions and several companies. Cardo has a wide range of different products such as pumps, garage doors, logistics solutions and docking stations. Before 2005, the different companies within Cardo were separate entities not cooperating. However, functions such as human resources, IT, communications, investor relations, finance and purchasing where all activities that was relatively similar across the whole organization. Therefore, these functions are now managed from headquarters. (Cardo E, 2008)

Purchasing, as mentioned above, is one of the activities administered from headquarters now. Since purchasing is one of the common functions, Cardo wants to utilize the total capacity of this merge. Cardo’s purchasing vision is:

To become our Suppliers’ most preferred customer.

To fulfill this, Cardo is going to utilize internal synergies via e.g. fewer suppliers, common procedures. Another important aspect is to be cost-efficient by using the right suppliers for e.g. raw material or subcontracting. Risk needs to be minimized risk by e.g. analyzing which suppliers Cardo wants to have a strategic relationship with. This is summarized in the following bullet-list:

- Utilize internal synergies
- Cost efficiency
- Minimize risks

Cardo aims to standardize procedures for working with purchasing across the company. One important issue for Cardo to address is whether to produce a product internally or buy the product externally. These kinds of decisions are often referred to as make-or-buy decisions. Considering the costs of raw material and labor involved in production, a decision like this becomes important for Cardo. One also has to take into consideration the strategic impact of such a decision Cardo; does the production of this product match Cardo’s strategic focus? Cardo does not have a standardized make-or-buy decision model today, which means that decisions are left to the different units and subject to managers own interpretation of what is important to consider. A standardized make-or-buy model would contribute to the realization of the purchasing vision because such a model would make sure that all the four points discussed above would be emphasized.

1.2 PURPOSE

The study’s purpose is to develop a generic model for make-or-buy decisions at Cardo.
1.3 **Concretization of the Purpose, Limitations and Directives**

*Generic* in this thesis implies that the model is meant to work for physical products within Crawford and ABS, but not services related to the products. For the purpose of this paper, the term *model* means that the model is supposed to give Cardo guidelines and ways of working rather than exact techniques of e.g. calculating costs. A model focused on giving exact figures is hard to make generic. A *make-or-buy decision* refers to the question of whether a company should produce a product themselves or let a supplier produce. The model is only working for outsourcing and not insourcing because of the risks that are not the same in the two cases. The term *develop* reflects the fact that the model is created with a base in theory and empirical data which will be evaluated to verify that the model is working well. The companies that are subject to the study are Crawford and ABS, as requested by Cardo. In addition, these are the two largest companies in Cardo. Due to time limitations, supplier selection procedures will not be examined.

1.4 **Work Methodology**

To be able to achieve the purpose of the thesis, the purpose is divided into smaller areas. The first area is identification of a theoretical model for make-or-buy decisions. In this area, a theoretical study is performed to find out what research show to be the most important components in a make-or-buy model. The reason why this is the first step is that it provides a basis for understanding the studied topic and being able to investigate the right aspects of an outsourcing decision. The theoretical study is presented in chapter 3. This study’s intention is to answer the following three questions:

- What is outsourcing and make-or-buy?
- What are the common components in a make-or-buy model?
- How can the components be identified?

The next step in the process is to conduct empirical studies by using interview sessions at two of the largest companies within Cardo. The purpose of the empirical study area is divided into five sub-areas; the first aims to find out how Cardo is currently dealing with the outsourcing issue according to them. The next four sub-areas derive from the theoretical study and these are: core-competence, risk, relationship and costs. Questions asked the interviewees evolve around these subareas.

Model version 1 is then modified based on a combination of empirical data collected and theoretical point of views. Subsequently, model version 2 is created. This model is evaluated to improve the model and the improvements are implemented in model version 3.
1.5 OUTLINE

This outline provides the reader with an overview of the structure of the paper, and functions as a guide throughout the reading.

Chapter 1
Introduces the background to the thesis and why it is relevant for Cardo. Furthermore, the purpose of the thesis is presented, in addition to the limitations and directives from the company. Lastly, a presentation of the work methodology is presented.

Chapter 2
A more thorough introduction of Cardo is given and the two case companies are presented.

Chapter 3
Based on the purpose, a deep theoretical study is conducted to gain understanding of research conducted in the theoretical fields of outsourcing and make-or-buy. Then, a deeper study of different make-or-buy models is made to find out what the most common components of such a model is. When these components are identified, each of them is defined and models are presented to illustrate how a company can work with them in make-or-buy decisions.

Chapter 4
Model version 1 is presented, which is a draft model with its base in theory.

Chapter 5
The purpose is divided into four main areas: theoretical research, empirical studies, comparison of theoretical study and empirical study, and lastly model evaluation. In each main area, questions are stated to be able to find out what each area consists of.

Chapter 6
In this chapter, a method for dealing with all questions stated in chapter 5 is described. The work is divided into the four phases presented in chapter 5. In each phase, the different methods to be able answer the questions are presented.

Chapter 7
Presentation of the empirical studies performed at five different sites.

Chapter 8
Discussion and analysis of the empirical data, compared to theory.

Chapter 9
Model version 2 is presented with base in model version 1 and empirical data. This is done without referring to theoretical references; to make the model user-friendlier. The references are instead referred in chapter 8. Notice, model version 2 is a draft version of the final model.

Chapter 10
Evaluation of model version 2, where several persons have reviewed the model and provided the model with suggestions for improvements. The major changes are presented and implemented in chapter 11.

Chapter 11
Model version 3 is presented, which is the final model.

Chapter 12
Includes reflections on the thesis and remarks to Cardo.
2 COMPANY DESCRIPTION

In this chapter, Cardo is described in more detail. The two companies investigated within Cardo are also introduced. This sets the frame of the thesis and gives the reader a better view of the two case companies.

Cardo origins from two of the most influential industrial groups in southern Sweden; Wilhelm Sonesson AB and Svenska Sockerfabriks AB Investment Company. Svenska Sockerfabrik’s AB Investment Company was founded in 1968 and named AB Cardo. In 1994, Incentive AB bought Cardo and introduced the company on the stock market. In the year 2005, the new management of Cardo started a process of change to recreate Cardo as an operative group with focus on the industrial market, the new strategy became:

“Cardo is a customer-oriented solution provider that helps to solve the global needs for clean water, efficient transportation and reduced energy consumption”. (Cardo D)

To implement the change process, strategic goals were created as seven points, which are related to all companies within Cardo. These points are:

- We will move from product focus to customer benefit.
- We will focus on selected customer segments and applications.
- We will offer value-adding solutions with quality products, a high service content and great applications know-how.
- We will build up a key account organization for large returning national and international customers.
- We will use our international service organization in a broader and more efficient way.
- We will invest more in emerging markets.
- We will make strategic acquisitions that either strengthen our market presence or add products and solutions to our selected customer segments.

(Cardo D)

Today, Cardo has almost 6 000 employees worldwide, with headquarters in Malmö in southern Sweden. Cardo is active in approximately 30 countries, most of them in Western Europe, which is also Cardo’s main market. The net sales in Western Europe are 75 % of the total, Eastern Europe are 7 %, Asia-Pacific 6 %, North America 6 %, Middle East 3 %, Latin America 2 % and others 1 %, illustration Figure 2. Cardo’s total sales were almost 10 billion SEK in 2008.

![Figure 2 Cardo AB Net Sales 2008, Source: Niklasson (2010)](image)

Cardo is divided into three different divisions; Entrance Solutions, Flow Solutions, and others, see Figure 3. (Cardo C, 2010)
Cardo Entrance solutions (CES) are one of the world’s largest manufacturers of industrial doors, docking systems, control and monitoring systems, and residential garage doors. CES is also Europe’s leading supplier of dock loading equipment and market leading equipment service. CES is the largest division within the group with approximately 61 % of the group’s net sales. The leading brands in the CES division are Crawford and Megadoor. The residential garage doors are the only part within Cardo focusing on the consumer market when offering garage doors and door automation solutions. The biggest brands within residential doors are Crawford, Normstahl and, Henderson. (Niklasson, 2010)

Cardo Flow Solutions (CFS) is a global supplier of pumps, mixers, aerators, compressors, and control and monitoring systems in the markets of water treatment applications and construction. CFS is the second largest division within the group with 31 % of total net sales. Cardo is the leading supplier of pumps, agitators and aerators for the pulp and paper industry, where the leading brand is ABS. In the division called others, Cardo is the global leader in measurement instruments, which is a rather small division with the major brands Lorentzen & Wettre. (Niklasson, 2010)

Cardo has since 2005 been organized as a matrix organization, which means that they are organized in supply chains focused on the different customers of Cardo. In addition, they are organized in different functions supporting the supply chains, illustration in Figure 4. This implies that one person in the supply chain also can have a position within the functional organization, meaning that one employee can have two different positions at the same time. For example, a purchaser at a factory can also be a category manager, meaning that the purchaser is responsible for a whole segment of products.

2.1 Crawford
Crawford is active in the CES division with approximately 3000 employees. Crawford operates in more than 30 countries and their major area is Western Europe. Crawford is a leading supplier of doors and logistics solutions. Crawford has a well-developed service offering customers repairs, replacement, preventive maintenance and upgrades for their own products as well as competitors and related products. (Cardo B)

2.2 ABS

ABS is active in over 100 countries worldwide offering technological solutions for wastewater with a full product range in the market, which includes pumps, mixers, aeration systems, control and monitoring equipment, and services. ABS is active in the CFS division within Cardo. ABS is also active in the dewatering market offering dewatering pumps, rental and service solutions. ABS is divided into four segments, where the three firsts are in the core business of wastewater: Domestic and Commercial Wastewater, Wastewater Collection Networks, Wastewater Treatment and Dewatering. ABS has 1800 employees and has approximately net sales of 3 billion SEK, which constitutes 31 % of Cardo’s total net sales. (Cardo A)
3 OUTSOURCING THEORIES

This chapter commences with an introduction to outsourcing that clarifies the concept and discusses the reasons to outsource. Furthermore, a literature study that identifies the most common aspects in outsourcing and make-or-buy decisions are presented and described in detail. Last in the chapter, interesting outsourcing models are discussed. These theories creates model version 1 for make-or-buy decisions, presented in chapter 4.

3.1 INTRODUCTION TO OUTSOURCING

According to Abrahamsson et al. (2003), outsourcing is the transition of existing and critical activities, which is not core competence, with belonging resources to an external party. Axelsson et al. (2002) defines outsourcing as “the decision and subsequent transfer process by which activities that constitute a function, that earlier have been carried out within the company, are instead purchased from an external supplier”. This definition is also supported by van Weele (2005). Brown & Wilson (2005) has a wider definition; “The act of obtaining services from an external source”. The definitions often describe outsourcing as a tactical and strategic decision to the company, and is not only about buying a product from an external source. Various researchers mention the make-or-buy decisions in the definition of outsourcing. The make-or-buy decisions are definitively a major aspect in outsourcing, for this thesis purpose the outsourcing definition has the same sense as make-or-buy, therefore the terms are used as equal.

The reasons to outsource are often focused on lower costs, e.g. outsourcing of the most ineffective activities. Other common reasons for outsourcing are; focus on core activities, and via outsourcing access world-class capabilities. Other reasons for outsourcing are to spread risks, to avoid major investments, to acquire new skills and new better management. (van Weele, 2005; Quinn, 1999; Brown & Wilson, 2005)

3.1.1 PREREQUISITES FOR OUTSOURCING

Before a company can outsource they have to prepare for the outsourcing. According to Brown & Wilson (2005), they first have to set a strategic direction for the organization and identify the company’s core competence. McIvor (2000) also implies the importance of the connection between outsourcing and long-term strategic decisions. If outsourcing decisions for components only are taken on short-term financial reasons, there is a greater risk that the core competences disappear and the company loses their competitiveness in the market. Bakker et al. (1994) argue for the importance to identify the core competences of the company when developing new business strategies. The process of developing a new business strategy should start with the identification of core competences; this provides the strategy with a wide range of possible directions to take for the company. The companies also have to determine the strategic objectives, identify interesting suppliers to collaborate with, implement an outsourcing process and form a governance team. This because the outsourcing decision has to be in accordance to the company policy, and the core competence is what makes the organization unique on the market. (Brown & Wilson, 2005)

3.1.2 REASONS TO OUTSOURCE

As mentioned above the most common reason is to lower costs and gain higher quality. The mechanism behind this is specialization; a company focused on few activities can have a higher productivity and effectiveness with higher quality than a company that produces everything in-house. These companies can also have higher volumes on a more narrow area of operations, which gives them economies of scale and fast learning curves. The economy of scale is possible because the companies have higher volume on their resources, which leads to lower marginal costs. This lowers the fixed costs that lead to a lower break-even point on their products. This is an advantage, especially when companies want to improve their financial performance in a short time perspective. (Abrahamsson, Brege, & Andersson, 2003; Gilley & Rasheed, 2000; Alexander & Young, 1996)

As mentioned above, a common reason to outsource is to focus on the core competences, which makes it possible to focus on the important aspects for the company’s uniqueness in the market. Another positive
aspect of outsourcing is that more of the management’s time is focused to the core activities and less on the non-core activities. This is positive since the support-functions do not contribute more than marginally to a company’s competitiveness. If a company fails to establish their core competences and only focus on price it is inviting to an erosion of a company’s core competences. (Abrahamsson, Brege, & Andersson, 2003; Gilley & Rasheed, 2000; McIvor, Humphreys, & McAlear, 1997; Brown & Wilson, 2005)

Outsourcing can also lead to a higher degree of strategic flexibility, which is important if a company is operating in a dynamic market. It is important to not be tied up with a special technology or a physical structure to be strategic flexible. When the company is flexible, it is possible to quickly respond to changes in the market and to implement new and improved technologies. This implies that an outsourcing company can take advantage of new, more cost effective technologies, i.e. more cost-effective than if they did it in-house. This can give them long-term advantages over competitors relaying only on internal production. This also allows the company to convert fixed costs into variable costs, which implies that the company can invest into their core activities. (Abrahamsson, Brege, & Andersson, 2003; Gilley & Rasheed, 2000)

3.1.3 OUTSOURCING PHASES
Most authors divide the outsourcing process into three essential phases; the strategic phase where the questions why, what, and who is answered; transition phase where the question how is answered. The third and last is the operational phase where the question how to manage is answered. (Momme & Hvolby, 2002; van Weele, 2005) For an illustration of the different phases, see Figure 5 below.

![Figure 5: The Outsourcing Process, Source: Van Weele (2005)](image)

The purpose for the generic model in this thesis is in the strategic phase, where the focus is in the question what. The other two questions are also of importance for an outsourcing decision, but in this study, they are excluded because of the time aspect and directives from the supervisor at Cardo.

3.2 COMPONENTS OF MAKE-OR-BUY FRAMEWORK
Several experts in the subject have investigated outsourcing and make-or-buy. Through a literature study, Table 1 has been developed to illustrate aspects in outsourcing brought up in literature. The table summarizes the most mentioned aspects, which is core competence, costs, risk, and relationship. These four aspects constitute the foundation for the remaining part of the literature study, since they are the most important aspects according researchers. A more comprehensive literature study with the four main areas is described in this section.
Core capability, core competence, and core activities are hard to distinguish from each other. To clarify the terms, core competence is first defined, followed by core capability and core activity. Last in this section, the correlation between the three expressions is described. Later in section 3.3.1, identification tools for core capabilities are described.

It is important that the company define its core competences to know what is creating their competitive advantage in the market (Quinn & Hilmer, 1994). Rothery & Robertson (1996) argue for the importance of evaluating how much time spent on core and non-core activities before a suggested activity should be chosen for outsourcing. In that manner, the company will be able to detect if too much time is spent on irrelevant activities. Other researchers argue that it is crucial for companies to define their core competences before deciding whether to outsource or not, otherwise the competitive advantage can be lost.

Quinn & Hilmer (1994) define core competence as skills or knowledge that cut across traditional functions, i.e. core competence is not products or functions. Furthermore, core competences are capable to adapt and develop skills in areas that customers will value over time. Typically, the number of core competencies in a company is limited and often they comprise of more than one but no more than five. A core competence is characterized by giving value to the customer more effectively than the competitors in the market give. At least one core competence should be related to understanding the customer and their needs. Moreover, core competence "refers to a company's ability to improve its performance continuously" (Smith, 2008, p. 48). The following bullet list is a summary of criteria for core competences according to Quinn & Hilmer (1994).

- Skills or knowledge sets, not products or functions
- Flexible, long-term platforms
- Limited in number
- Unique sources of advantage in value chain
- Areas where the company can dominate
- Elements important to customers in the long run
- Embedded in the organization’s system

### TABLE 1 HIGHLIGHTED ASPECTS BY RESEARCHERS

<table>
<thead>
<tr>
<th>Author</th>
<th>Core Competence</th>
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Another definition of core competences is “skills, knowledge and technological know-how that give a special advantage at specific points of the value chain” (Long & Vickers-Koch, 1995, p. 12); this corresponds to parts of Quinn & Hilmer’s (1994) definition. A core competence and a strategic process together creates a core capability, the latter defined as “the most critical and most distinctive recourses a company can possess and the most difficult to copy when effectively linked with appropriate strategic targets in a value chain that begins and ends with the company’s key stakeholders” (Long & Vickers-Koch, 1995, p. 13). Furthermore, a strategic process is “the business process you use to deliver your special know-how in the form of products, services and other results that have high value to customers and other stakeholders” (Long & Vickers-Koch, 1995, p. 13). Another definition of core capability is “the organizational ability to execute activities repetitively, efficiently and predictably” (Smith, 2008, p. 47).

A competence and a process will always build various types of capabilities. Long & Vickers-Koch (1995) define two main types of capabilities, the first one being threshold capabilities consisting of basic and service capabilities. Basic capabilities are necessary for the company to do business in market, and services capabilities provide services such as human resources, legal, and accounting. The other types of capabilities that give the company its competitive advantage are called core capabilities. The core capabilities are further divided into critical core capabilities and cutting edge core capabilities, the first provides today’s competitive advantage, and the latter creates tomorrow’s competitive advantage. (Long & Vickers-Koch, 1995) This classification is illustrated in Figure 6.

![Figure 6: The Structure of Capabilities](image)

**FIGURE 6 THE STRUCTURE OF CAPABILITIES**

To understand the core capabilities, companies must also understand what core activities are, defined by McIvor et al. (1997, p. 173) as “central to the company successfully serving the needs of potential customers in each market”. This definition has the same tendency as Long & Vickers-Koch (1995) has when they define a process. Therefore, these two expressions will have the same meaning for the purpose of this thesis. Quinn (1999) describes three different types of activities within a company; Core that has the best in world capability, Essential Non-Core that is demanded by customers or to support the core, and Non-Core which will be considered to outsource. Arnold (2000) has a similar description that she calls the outsourcing object, which is the activity for the outsourcing decision. Instead of three activities, the activities are divided in four. First, company core that consists of all activities connected with a company’s existence. The second type of activities is core close activities, which are directly linked to the core activities. Third, core-distinct activities that are supporting activities and the last type of activity are disposable activities that have a general availability, illustration Figure 7.
FIGURE 7 A COMPANY’S DIFFERENT ACTIVITIES

In this case, both Quinn (1999) and Arnold (2000) have separated a company’s activities but they have done it in different level of detail. It is common that researchers make a distinction between core activities and non-core activities (Rothery & Robertson, 1996; Brandes, 1994). For the purpose of this thesis, a more detailed level is needed to be able to combine product type with right supplier and right relationship (Brown & Wilson, 2005; Sanders, Locke, Moore, & Autry, 2007). Brown & Wilson (2005) argue for the importance of noticing the difference between a critical function and a core competence. A critical function can be outsourced to a “best in class vendor” but this is not a recommended practice for core competences. An operation within a company can be critical and there can be many of them, in contrast to core competences, which are limited in number. It is easy to mistakenly identify a critical function as a core competence and therefore choose not to outsource, this can have an impact on the company’s strength in the market. (Brown & Wilson, 2005) Moreover, top management with inputs from lower level teams should perform the identification of core activities (McIvor, 2000).

A clarification of the term core competence and its close related terms core activity and core capability are illustrated in Figure 8. The core competence and the core activity must work together to become a core product or service, which is called a core capability. These three together creates the competitive advantage in the market. In this thesis, the term core capability is used as the general term when discussing the core competence and core activities. Several researchers use the term core competence as an aspect not to outsource, but it is the combination of core competence and core activities that is important to protect. To identify the core capability a company still needs to identify both their core competences and core activities.

FIGURE 8 FROM CORE COMPETENCE TO COMPETITIVE ADVANTAGE

3.2.2 Risk

When a company chooses to outsource they are also taking a risk that is one of the most highlighted aspects in outsourcing research. Quinn et al. (1994) argue for outsourcing as a tradeoff between benefits and risks. To provide an overview of the risks associated with outsourcing, the major risks highlighted by researchers are presented in this section. These risks are grouped in categories and summarized in the end of this section and models to define risks related to outsourcing are presented in section 3.3.2.
Three major risks in outsourcing are technical risk, risk related to relationship and commercial risk. The technical risk is related to the functionality and performance of the supplier. The outsourcing company has to make sure, that the provider applies leading-edge technology and solutions, and that the provider remains capable of performing the desired job over time (van Weele, 2005; Brown & Wilson, 2005). In the risk related to relationship, it is important to understand the difference between external and internal sources. Examples of this are that delivery service may change, and unexpected cost can occur in an outsourcing collaboration (Brown & Wilson, 2005). Van Weele (2005) mentions contractual and supplier performance risks that can be classified as risk related to relationships. Contractual risks consider risks related to the contract. Relevant questions to ask in this matter include whether the penalties in the contract are useful, can it be used without destroying the relationship etc. Supplier performance risk, deals with issues like whether the provider is capable of performing what is agreed upon, if they have resources and capabilities enough, and if the right quality can be delivered (van Weele, 2005; Brown & Wilson, 2005). Commercial risk is related to the price and cost that should be paid for the outsourced work. It also includes extra costs that may occur when the company outsources (van Weele, 2005).

Abrahamsson et al. (2003) also argue for risks related to the relationship, which is defined as relationship risks in this thesis. Several issues in outsourcing can be related to supplier dependence, examples for supplier dependence situations are when there are too few suppliers in the market, lack of competence in purchasing, and a need of very specific products. In these situations, the supplier can for example increase the prices on products, which can be hard for the contractor to do anything about (Abrahamsson, Brege, & Andersson, 2003). This is in line with Quinn & Hilmer (1994) and Raiborn et al. (2009) argue for in the loss of control over the supplier. Sanders et al. (2007) discuss that one possible risk is if many clients compete for the supplier’s service and the supplier do not manage to handle all clients. Abrahamsson et al. (2003) discuss the risk of imitation and how this in the end can lead to a lower competitive strength. This risk increases if a company outsources research and development to a supplier as well. This because the supplier can provide other competitors the exact same products after a while, which can damage the outsourcing company in the end. As suppliers get more and more knowledge of the product being manufactured, the supplier may use this and begin to market this product on their own. (Abrahamsson, Brege, & Andersson, 2003; Gilley & Rasheed, 2000; van Weele, 2005)

To lose a core competence is another risk, because core competences are hard to identify and it is even harder to foresee the future core competences. Another aspect is that it not always possible to separate the outsourced activity from the rest of the business (Abrahamsson, Brege, & Andersson, 2003). Loss of innovation is a risk that occurs when parts of the company related to innovation or development is outsourced, which may lead to the company’s innovation or development skills are weakened (Raiborn, Butler, & Massoud, 2009). Another risk related to the core competence risks are loss of critical skills or developing the wrong skills, a situation when the company outsource critical functions that should have been kept in-house (Quinn & Hilmer, 1994).

It is also very important to remove related activities after the outsourced activity; otherwise, this can lead to double costs. In many cases companies tend to forget to do their internal work and just focus on the external connection to the supplier. The lack of ability to change is when the company should change from doing to buying and not able to handle the new area. Furthermore, if too many activities are outsourced, a company will have very low own value added to the product. When the outsourcing company source to a global supplier they can experience problems when negotiating for a lower price from the supplier at the same time, as the market wants lower prices. This leads to an unpleasant situation for the outsourcing company which is called the outsourcing trap, see Figure 9. (Abrahamsson, Brege, & Andersson, 2003) It is difficult to identify all costs related to outsourcing, therefore a major risk for hidden costs exists, and this can lead to a higher cost than initially expected. (Sanders, Locke, Moore, & Autry, 2007; Raiborn, Butler, & Massoud, 2009) Moreover, when a component or product is outsourced, the overhead costs have to be carried by all the other products. This can
make the other products to appear more expensive, because their manufacturing costs increases. If a manager
not is aware of this, the decision to outsource these products as well is easy to take, which becomes a negative
cycle according to Brierley et al. (2006).

![Diagram of price vs. cost over time]

**FIGURE 9 THE OUTSOURCING TRAP, SOURCE: ABRAHAMSSON ET AL. (2003)**

Even if an activity is non-core, it does not necessarily imply that it should be outsourced. One example of this is
the supplier dependence risk. In situations with a high supplier dependency risk, benefits of keeping the activity
in-house will be greater. The same scenario applies to situations where the supplier is weak. The outsourcing
company has to support the supplier with training, co design etc. (Quinn & Hilmer, 1994). According to van
Weele (2005), one of the major disadvantages with outsourcing is the increased dependencies on suppliers.
This view is also supported by Quinn et al. (1994), whom is arguing that it is important for the relationship
between supplier and customer to have a good match in priorities. The reliance of outside suppliers is also
likely to lead to a loss of overall market performance, which in the end can suppress the market development
(Abrahamsson, Brege, & Andersson, 2003). Risks in information are also important to have in mind, the
supplier can hide problems concerning raw material and the customer will not be notified before it is too late,
referred to as communication risks in this thesis. (Quinn & Hilmer, 1994)

When a company chooses to outsource it will have consequences for the employees such as layoffs and a
higher workload. This is called loss of organizational trust, a situation where the employees no longer have
confidence in the organization (Raiborn, Butler, & Massoud, 2009). In addition, loss of trust can create a risk
called loss of cross-functional skills a condition where the company loses their opportunity to work with
different people from different functions or activities within the company (Quinn & Hilmer, 1994). When
activities disappear from the company, it will difficult to keep the knowledge within the company and it will be
hard to take it back in-house again (Mahmoodzadeh, Jalalinia, & Nekui Yazdi, 2009).

The following bullet list has been created to provide an overview over the risks related to outsourcing. It
consists of main risks and risks associated with these main risks.

- Technical risk
- Risk related to relationship
  - Contractual risk
  - Supplier Performance risk
  - Supplier dependence or loss of control
  - Risk of imitation and worsen competitive strength
  - Communication risk
- Commercial risk
- Loss of core competence
  - Loss of critical skills
  - Developing the wrong skills
  - Loss of innovation
• Lack of ability to change
  o Double costs
  o From doing to buying
• Loss of knowledge
  o Loss of cross functional skills
  o Be able to take activity back in-house
• Hidden Costs
• Loss of organizational trust

3.2.3 COST

One of the most common aspects in outsourcing is cost and the identification procedure of costs related to outsourcing decisions. When investigating costs of an outsourcing decision it is very important to find all costs related to the decision, both the quantifiable and non-quantifiable factors involved in the total cost (McIvor R., 2000). To develop a total cost model, a four-step method is applied in this section, which is recommended by Oskarsson et al. (2006).

1. Describe how the system will be affected by the change being made. The quality of the calculations is highly depending on the person executing them, and therefore it is very important that the person doing the calculations have a wide knowledge of the system.
2. Develop a total cost model where all the costs affected by the change are included.
3. After this, a judgment of which costs that is significantly affected is performed.
4. Revise the model; only the costs that are significantly affected should be included, this will save a lot of work. This procedure adjusted the working procedure for a specific situation.

Oskarsson et al. (2006)

Step 1 is performed through the purpose of this thesis. It is the total cost in make-or-buy decisions that are investigated. Step 2 is performed in this section, where a theoretical study reveals all affected costs in make-or-buy decisions. Step 3, to identify the most significant costs, theory and empirical data must be compared. This is performed in section 3.3.3. The last step is applied when the model is tested in real cases.

3.2.3.1 TOTAL COST PERSPECTIVE

Total cost of ownership (TCO) is a method to cover the total cost of a company. TCO is often mentioned in purchasing and operations literature. TCO is defined by Trent et al. (2005, p. 364) as “the present value of all costs associated with a product, service, or capital equipment that are incurred over its expected life time”. Cousins et al. (2008) argue that TCO consider all costs involved in a company’s supply chain such as cost linked to quality, delivery service, ordering, reception, inspection and transportation. Trent et al. (2005) and Saunders (1997) have developed four respective three categories for the TCO term, based on other researcher’s articles. Trent’s et al. (2005) four categories are purchase price, acquisition costs, usage costs, and end-of-life costs. Saunders’ (1997) three categories are costs of acquiring a product, costs of processing a product, and costs of sustaining.

Cost of acquiring a product includes all costs to get the product from the supplier, such as administration costs and freight taxes (Trent, Handfield, & Monczka, 2005). Saunders (1997) mention a similar term that includes unit purchase cost of the product, cost of specification, evaluation, supplier selection costs, cost of expediting, receiving and inspection. Trent et al. (2005) and Saunders (1997) differentiates within this area, Saunders (1997) has unit purchasing included and Trent et al. (2005) has purchasing price in a separate category. The second category is usages costs, which Trent et al. (2005) define as costs associated with the converting of the purchased part/material to an end product and costs needed for supporting the product through its usable life. Saunders (1997) has a narrower category, that fits within usage cost, that only take into consideration the costs to make sure that a product is ready for manufacturing, e.g. costs for faulty products, cost of holding stocks of
the item, and handling and transportation costs. Saunders has one additional category that fits in the usages
cost which is cost of sustaining. This cost is covering the factors involved that makes it possible that the product
can be delivered in the future, such as supplier audits and supplier education. Trent et al. (1997) also
mentioned the end-of-life cost, which is associated with the costs occurring when a product reaches the end of
its lifetime, such as disposal and cleaning costs.

Furthermore, pricing models are interesting to take into consideration to cover total cost perspective. Trent et
al. (2005) present a pricing model consisting of direct material cost, direct labor cost, production overhead
costs, selling and administrative costs, and profit margin. The first three cost elements are called direct costs,
but if selling and administrative costs are added, it is named supplier’s total cost. Lyson & Farrington (2006)
mention absorption costing which is similar to Trent’s et al. (2005) pricing model. Absorption costing consists of
price composition, material costs, indirect costs, production and overhead costs, labor costs, non-production
costs, and profit. In make-or-buy analysis, the profit is excluded because it is the same in the make alternative
(MA) and the buy alternative (BA).

In make-or-buy decision, the cost of manufacturing is an important aspect in the total cost analysis. Benton,
(2007) defines total manufacturing cost as; direct material costs, direct labor costs, and burden (overhead). Burden is fixed and variable costs, which is similar to the previous defined absorption costs. Baily et al. (1998)
argue that all cost associated with a manufactured item is prime costs. Prime costs and factory overhead costs
create a work costs. Prime costs include direct materials, direct labor, and direct expenses. Factory overhead
costs include fixed and variable expenses. The work cost together with administrative and sales overhead costs
creates the total manufacturing cost. According to Glad and Becker (1996), cost for manufacturing a product
includes the following costs; salaries and wages, power, depreciation, machine tools, cleaning material, rent,
and maintenance costs.

Oskarsson et al. (2006) has developed a model for covering the total cost from a logistic perspective that is
similar to the model presented by Grant et al. (2006) and also to the model by Stock & Lambert (2001).
Oskarsson’s et al. (2006) model consists of five cost categories. First, cost of risk and cost for tied up capital
in the inventory called carrying cost, e.g. cost of obsolescence, waste, and insurance costs. The size of these costs
is related to the amount of products stored in the inventory. Second is warehousing costs, which are related to
the warehouse itself and the staff involved in the warehousing. This can be personnel costs, costs for storage
areas / buildings, equipment for handling goods (e.g. cranes, forklifts), costs for other storage equipment such
as shelves and administrative inventory-handling system. The transports within the warehouse are also
included in the warehousing costs. The next cost element is transportation costs that include both internal and
external transportation costs, but excludes the transports within the facilities. The external transportations
costs depend on the delivery terms between buyer and supplier, also called incoterms. The different incoterms
are defined in Appendix C. Fourth, administrative costs are costs related to the administration of the logistic
system, e.g. billing, reception of orders, salary payments and economical follow-ups. Fifth, other costs are
related to the product that does not fit into one of the other categories above are placed in this category. This
can involve different types of costs, e.g. packing material, information systems handling the flow of goods,
marketing costs.

3.2.3.2 Cost Categories
The costs described above are divided in different categories by different researchers. All researchers cover the
total cost from a perspective; it can be a purchasing, operational or logistic perspective. Therefore, cost
categories differentiate and cost elements are described in different categories. To construct a total cost model
for make-or-buy analysis, the cost categories from each perspective are taken in consideration and significant
categories for the analysis is created. Each category’s cost elements are also combined from the categories
mentioned above. The total cost model is described below and illustrated in Figure 10.
Carrying cost
The carrying cost includes the parameters such as, holding costs, work in progress (WIP), obsolescence and waste. Saunders (1997) had holding cost within the category usages cost. For this thesis, the holding cost is included in the carrying cost that also contains work in progress costs.

Manufacturing costs
Within this category direct labor costs, direct material price and quality costs are included. The direct material price consists only of the purchasing price. It is important to keep in mind that this cost can be divided into other cost categories depending on what is included in a quote, e.g. transportation costs. Direct labor consists of the wages for the machine-operators. The quality costs consists of all the extra quality costs that occur within the production facilities and not when the product has left the building, e.g. at a warehouse or installed at the customer’s facilities.

Facilities costs
Facilities are defined as the warehouses, factories and other facilities. The facilities cost includes the staff wages related to the facilities and cost directly linked to the facilities such as insurance costs. The staff included in this category has a support-function, such as forklift-operators, cleaning personnel and janitors. It is important to know that the staff does not include the machine-operators and white-collar workers. Other costs within this category are; Costs for storage areas / buildings, equipment for handling goods and producing (e.g. cranes, forklifts, tools, and production-machinery), costs for other storage equipment such as shelves and administrative inventory-handling system. The costs for transports within the facilities are also included in the facility costs. Cost of expediting, receiving, inspection and incoming quality control are also included.

Transportation costs
Both internal and external transportation cost are included, the only transports that not is included within this category is the transportsations inside the warehouses and factories. Costs associated with the transports are also included, e.g. freight taxes and custom duty.

Overhead costs
Overhead costs for departments such as R &D, purchasing, production, sales and financial departments. Within this category, costs such as supplier audits, support costs, communication costs and costs related to the relationship are included. All administration costs related to the product such as billing, reception of orders, salary payments and economical follow-ups is also included in the overhead costs.

Other costs
Other costs includes all other costs related to the make-or-buy decisions that do not fit in any other category, e.g. information systems, marketing currency costs, payment fees, end-of-life costs. It is important to take into consideration costs that do not fit in the categories, as they can affect the total costs significantly. Notify, if extra quality costs occur outside the production facilities they must be accounted for in this category.

FIGURE 10 TOTAL COST
3.2.4 RELATIONSHIP
In this section, the correlation between risk and relationship is described. The section continues with a description of different relationships that were identified in the literature study. The literature study also generated relationship models that place the optimal relationship for different situations; this is explained in section 3.3.4.

When a company is buying instead of making, it involves a relationship with a supplier. Relationships also include risks, which are important to reduce; one approach is to select right type of relationship for the outsourcing task, which also leads to a successful outsourcing. Brown et al. (2005) state the importance that the buyer-supplier relationship is flexible and able to evolve over time. This is also supported by Brandes et al. (1997) that argue; a long-term relationship builds on trust. The most traditional and common demands on a supplier in a relationship are quality, delivery reliability, and price. Nowadays, quality and deliverability are taken for granted and new demands on development are created. This drives the market, which implies that the supplier can produce more and more complex products. This often means that the supplier must be involved earlier in the development process and take a greater responsibility over the process (Brandes, 1994).

In supplier dependence, the important aspect power is included, which can be explained with dependence in four different forms. First, no dependence, where both parts are independent of each other and there is no power relative each other. This means that both parts in the relationship have other players to use in the market. Second, occur when both parts in the relationship are depending on each other and take responsibility of the relationship. Third, irregular dependence with power disadvantage is when one part has more power on the other part. To do changes directed against the other part makes them more dependent. Forth, irregular dependence with power advantage is when a company is aware over the advantage and uses it, e.g. gives rewards to the other part when a task is performed correctly; they retain the power advantage. (Cook, 1977; Huge-Brodin, 2009)

Sanders et al. (2007) define four types of relationships. Nonstrategic Transactions, is the category that has low critical activities. They are often transaction-oriented and products are standardized. The Contractual Relationships, where greater controls over business and supplier is needed than in the Nonstrategic Transactions (Rinehart, Myers, & Eckert, 2004). The critical level is still low but it is a moderate level in communication, dependence exists between client and supplier. Partnership, where a critical activity is outsourced but it is low in scope. It is a strong relationship between the parties. The fourth and most comprehensive relationship is Alliances, where both the critical activity and the scope of the outsourced activity are high. It is a high level of confidence in capabilities and integrity of the other party, investments in relationship management is needed. These four types of relationships are summarized in the following bullet-list. (Sanders, Locke, Moore, & Autry, 2007)

- Nonstrategic Transactions
- Contractual Relationships
- Partnership
- Alliances

3.3 HOW TO DEFINE COMPONENTS IN A MAKE-OR-BUY FRAMEWORK
From the literature study several models for make-or-buy and outsourcing decisions has been identified, but also models that identify the most central aspects highlighted in this thesis. In this section, the most useful models are presented. This is presented from the core capability, risk, cost, and relationship perspectives.

3.3.1 HOW TO DEFINE THE COMPANY’S CORE CAPABILITY
The importance to identify the core competence in make-or-buy decision has been clarified in section 3.2.1. To ease the identification process of the core competences researchers has developed models for companies to
follow. First, the SWOT (Strengths, Weaknesses, Opportunities, & Threats) analysis and focused SWOT analysis described. The section ends with description of other interesting models.

3.3.1.1 SWOT Analysis
In addition to the evaluation of the strengths, weaknesses, opportunities, and threats, the SWOT analysis is involving the monitoring of external and internal marketing. According to Armstrong & Kotler (2007), strengths are internal capabilities that help the company to reach its objectives i.e. what they are good at. Weaknesses are also internal but instead it can stop the company to reach its objectives, i.e. what they are less good at. Opportunities are external factors that the company can use to an advantage but cannot affect, e.g. a political decision that is in favor for the company’s business. Threats are external factors that can affect the company’s performance negatively, e.g. extreme weather conditions for airline companies.

This thesis focuses on the strengths and weaknesses of the SWOT analysis, because the opportunities and threats are not needed to identify the core competences of the company. The procedure to identify the strengths and weaknesses is through a table, which is divided in performance and importance in the market. Performance is how the company performs in the areas marketing, finance, manufacturing, and organization (Kotler & Keller, 2006). Each area has sub categories so that the company can chose them when evaluating if they are weak of strong in a specific area. Examples of sub categories in the marketing category are service quality and product quality. For the financial category, the sub categories can be liquidity, etc. The manufacturing category can include facilities, economics of scale, etc. The organization category includes aspects such as, flexible or responsible organization and dedicated employees. Each subcategory is graded on how well the company perform in each area, e.g. in a scale from 1 to 10. Each subcategory is also graded on how important the category is in the market, e.g. in a scale from high to medium or a scale from 1 to 10. According to Kotler & Keller (2006), the result should be presented in a matrix. Each sub category is placed in the matrix in accordance to the scale from one to ten. The matrix makes it easier to identify what they should monitor and concentrate at, but also what they must keep up with and what they put too much effort in.

3.3.1.2 Focused SWOT Analysis
The focused SWOT analysis presented by Coman & Ronan (2009) differentiates from the SWOT analysis presented by Kotler & Keller (2006). Coman & Ronan take the analysis one-step further and identifies the company’s core competences and core problems instead of just strengths and weaknesses. The analysis starts with the identification of the company’s strengths, but not according to Armstrong & Kotler (2007). Instead, they use the event-factor review (EFR) that is analyzing value creation and destruction and creates a list of strengths and weakness. The list is created through events, such as winning a first tire customer contract. From this event, the major factors of winning against their competitors are listed as strengths. Even what they were less good at should be listed as a weakness, illustration Table 2. The EFR should at least consists of six to nine events that have a significant impact on the company’s value that can be winning or losing tenders, meeting technical challenges and substantial profits or losses in a given market segment.
### Event-Factor Review

<table>
<thead>
<tr>
<th>Event</th>
<th>Factor</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outcome</strong></td>
<td>Description</td>
<td>Strengths</td>
</tr>
<tr>
<td><strong>Successes</strong></td>
<td>Winning a first-tier customer contract</td>
<td>Rapid multidisciplinary product development Good engineering and production Good interdisciplinary communications</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Etc...</td>
</tr>
<tr>
<td><strong>Failure</strong></td>
<td>Failure to sell to the leading company in the market</td>
<td>Technological leadership</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Etc...</td>
</tr>
</tbody>
</table>

**Table 2 EFR, Source: Coman & Ronan (2009)**

The EFR generates a list of strengths and weaknesses. According to Coman & Ronan (2009) the list must be, concise, actionable, significant, and authentic. The reason for this depends on previous studies Coman & Ronan have performed where they identified drawbacks about the SWOT analysis. **Concise**, the list cannot burden executives with routine responsibilities; only the core strengths should be included, (Davenport & Beck, 2001) in (Coman & Ronen, 2009). **Actionable** means that items easily should follow the goals provided by executives to supply the problems, items should call for actions. **Significant** means that the items have a major impact on the company’s value. Items that have actionable weaknesses should be removed from the analysis. The last criteria, **authentic** imply that the list should be real rather than wishful thinking (Coman & Ronen, 2009).

When the list is formed, the core competences can be identified with the core competence tree (CCT) and the core problems with the focused current-reality tree (fCRT). The fCRT is a simple and time effective method used to identify core problems and it has the same procedure as the CCT, therefore are just the CCT explained. This technique consists of three different steps depending on the analyzed subject (strengths or weaknesses). The three steps for analyzing the strengths are; first, reduce the list of strength from redundancy, vagueness, and irrelevant symptoms. Second, linking the strengths using cause-effect logic and step three is to discover two to three core competences. The three steps for the weaknesses are; first, reduce the list of weaknesses from redundancy, vagueness and irrelevant symptoms. Second, linking the weaknesses using cause-effect logic and third is to discover two to three core problems, illustration Figure 11. (Coman & Ronen, 2009)

#### 1. Reduce the lists

- From
  - Redundancy
  - Vagueness
  - Irrelevant symptoms

#### 2. Linking

- Strengths/Weaknesses
- With
- Cause-Effect Logic

#### 3. Discover

- Core Competences
- or
- Core Problems

**Figure 11 FCRT Steps**
Furthermore, it is important to focus on strengths that the company has control over. Similar strengths should be grouped into categories and less important strengths should be removed. Coman & Ronen (2009) argue that strengths and weaknesses often are linked to cause-effect relationships, which the CCT model uses to identify the core competences. The procedure is; develop a tree that has a leading strength, e.g. creation of owner value, in the top and all strengths linked to the leading strength attached with cause-effect arrows. The linked strengths are those from the developed list in the EFR step, but it can also include new strengths that occur when different strengths are linked to each other. This method ends with a few strengths that cannot be linked to other strengths; these are the company’s core competences, illustration Figure 12. (Coman & Ronen, 2009)

![Figure 12 FCRT, Source: Coman & Ronen (2009)](image)

3.3.1.3 Competence Pyramid
Walsh & Linton (2001) present two major aspects to identify core competence in their competence pyramid; identify the technological competences and the marginal capabilities that are linked to the competences. This is analyzed from three different angles. First, identify the competencies and capabilities of the firm, followed by the identification of the competitor’s competences and capabilities. Last, identify the competences and capabilities that are needed for producing a product. The first perspective, gives the provided information a lead on suitable products and industries to compete with in the market. The first perspective provides a lead on what to develop, in matter of competence and capability, for the future and what to withdraw from the market. The benchmarking between the company and its competitors identifies the company’s advantage on its competitors. (Walsh & Linton, 2001)

3.3.1.4 Value Chain Analysis
A popular method to identify the core competence of a company is value chain analysis. Value chain is a tool that systematically evaluates all activities that a company performs and how they interact, this to be able to analyze the sources to the competitive advantage. The value chain consists of value activities and margins. The value activities are technologically distinct activities that the company performs, which is the building block that creates the value in the product for the customer. The margin is the difference between the value created and the total cost to perform the value activities (Porter, 1985). To calculate this margin, Dekker (2003) argues for the activity based costing (ABC) analysis. Where the value increases the most, is an indicator on strengths that can be core competences.

3.3.2 How to Define Risk Related to Outsourcing
An effective method to quantify the impact of risks related to outsourcing is decision support systems. These are also common in supplier selection problems, but are more advanced in this area. Weber, Current & Benton (1991) describes three different methods for assistance in supplier selection problems: linear weighting models, mathematical programming models and statistical/probabilistic approaches. Linear weight methods are the most utilized methods, where a weight are placed in each criterion, and provide a total score for each

- Identify the factors or criteria for evaluation.
- Determine the importance of each factor.
- Establish a system for rating each supplier on each factor.

They continue with a discussion on how to address weights to each factor, where one opportunity is to give a percentage for each weight, in the end the sum of all weights should become 100. An example of a linear weighting model is the weighted point method (WPM). The model is divided in a number of criteria and at least two alternatives. Each risk are weighted against each other and graded in importance, e.g. one to five. Each category for each alternative is graded in matter of how high the risk is, e.g. one to five. The grades are after that multiplied by the weight for the specific risk, all the weighted points are summarized and highest score has the highest risk and should not be chosen (Oskarsson, 2009). Other researchers have developed models that connect risk and relationship, which is not suitable in this risk analysis. If the thesis had focus in supplier selections for outsourcing, these methods had been more interesting. Examples of supplier selection models are Quinn (1999) and Sanders, Locke, Moore & Autry (2007).

3.3.3 HOW TO DEFINE COSTS RELATED TO OUTSOURCING

A way of covering all the costs related to the make-or-buy decision is to use Activity Based Costing (ABC) (McIvor R., 2000). The basics in ABC are explained in this section. All activities performed in a company are performed to support the production and distribution of the company’s products. When manufacturing, resources are used by activities with the purpose of producing an output from the activity. These activities have been given costs that are dependent on how much they use the different resources. This cost can then be allocated to the cost objects based on how much the products use the activities. The connection between resources, activities and cost objects are shown in Figure 13 below. (Gerdin, 1994)

![Figure 13 Basic Concepts and Links in ABC, Source: Gerdin (1994)](image)

**Resources** are defined as factors of production such as technology and material that are required to perform the activities. Consumption and possession of resources generate costs. The direct costs are allocated to the products directly and the indirect costs are allocated to the cost objects and activities via different allocation keys. (Gerdin, 1994)

The term **resource driver** is a measurement of how much an activity consumes a resource. The **activities** are in-between functions and job assignments. The optimal solution occurs if all assignments within an activity are included, but this often too detailed. It is also important to have a homogenous output from an activity to be able to define a products usage of an activity. In what level the activity is defined depends on the connection between the measurement-cost and quality of the calculation. A higher quality will cost more in terms of time...
for measurement. An **activity driver** is a measure of how much a product consumes an activity. The last term in ABC is **cost objects** that are the objects of the calculations, e.g. products, manufacturing orders or customers.

Another common way of allocating costs is called period costing. This is a basic procedure of allocating costs to products. This type of costing is adapted when the products are standardized and with high volume. The allocation of costs is done with three different methods: (Ax, Johansson, & Kullvén, 2005)

1. **Division method**: \( \frac{\text{total cost for a period of time}}{\text{volume}} = \text{cost per product} \)
2. **Normal method**: \( \frac{(\text{variable costs})}{\text{volume}} + \frac{(\text{fixed costs})}{(\text{normal volume})} = \text{cost per product} \)
3. **Equivalent method**: uses equivalent number to calculate the price. This is then multiplied with the volume to get equivalent volume. This is then multiplied with the total cost and divided with the volume to get the cost per product.

Both the division and normal methods assumes that every product uses the same amount of resources. The equivalent method considers the consumption of the different resources. (Ax, Johansson, & Kullvén, 2005)

### 3.3.4 How Define the Most Suitable Relationship Related to Outsourcing

Kraljic’s (1983) matrix is widely used to select supplier relationship. The model considers the combination of financial risk and supply risk, which can be divided into four different sets in a 2x2 matrix. Each square in the matrix gives guidance on how the company should act when choosing their supplier relationship, see Figure 14 below. This is also supported by Gelderman & van Weele (2002) who have completed studies on how a large company used Kraljic’s matrix and identified the advantage of managing supplier relationships with Kraljic’s matrix. The four alternatives in the matrix are leverage, strategic, non-critical, and bottleneck products, which will be explained below.

![Kraljic's Portfolio Matrix](translated-from-kraljic-1983)

In the **non-critical** quadrant, a company should use the open market to push the price down and should not have any strategic relationships with their suppliers, because the products are easy to buy from many suppliers and has low financial risk, which is typical for standard products. The buyer can have longer agreements with suppliers to ensure the supply of products and to minimize their own workload. In the **leverage** quadrant, the company has to exploit their purchasing power, because there are many suppliers with a high purchasing value in each buy. It is recommended that the company purchase components, and use the competition in the market. Leverage items are with low risk but with high financial impact for the buying company. In the **bottleneck** quadrant, it is important for the buyer to secure supply of the products. Therefore, it is recommended to start long-term relations with the suppliers delivering bottleneck products to secure the supply. The reason for this is that there are only a few suppliers able to deliver the products, but it is a low financial risk involved. The last quadrant is the **strategic** where the products are of high financial and supply risk, i.e. there are few suppliers able to deliver and the purchase is of high financial risk to the buyer. In this
category, it is important to secure supply and this can be done via strategic relationships with the supplier. (Kraljic, 1983; Gelderman & van Weele, 2002)

More advanced methods are presented by researchers, e.g. Rinehart, Myers & Eckert (2004), Cox (1996), and Sanders, Locke, Moore & Autry (2007). These methods are excluded from this thesis because of limitations in time and that the focus is in core competence, risk, and costs aspect.

3.4 Model Theory

In the literature study, several models for outsourcing and make-or-buy decisions were identified. A number of these were complex to understand and not very practical for a company to use. One example of this is Vyankatrao & Jenamani’s (2008) make-or-buy model that provides 17 steps combined with arrows that leads to the answer make or buy. The picture is very confusing and poorly explained how to use. It also seems very complex and the feeling is that the framework is difficult to use, even if it not is so. Momme & Hvolby (2002) has many interesting findings in their article but in the end, they have adapted a framework and modified it. The problem is that they try to get to much information into one picture. It seems more complex than it is, and therefore not a suitable model or framework in this thesis.

Others had better structure and were easier to follow; McIvor (2000) present a framework that contains relevant and logical steps, which also is easy to understand when just looking at the picture of the model. Brandes (1994) model was identified as the user-friendliest model. It provides an overview of the most significant aspects that also was similar to the identified aspects in the literature study. The method is also generic, i.e. it suits a wide spectrum of different make-or-buy analysis. This model constitutes the base in this thesis for the connection between the four identified building blocks. Brandes’ (1994) model consists of three perspectives; Strategic resource perspective, power/dependence perspective, and cost analysis perspective. The strategic resource perspective should first be analyzed in an outsourcing decision, where an investigation if it is a core competence or not should be performed. If the answer is yes, the company should not outsource, but if the answer instead is no, more analysis must be performed from the power/dependence perspective. In this perspective, an analysis of supplier dependency risk is performed, if the answer is yes in the analysis the company can decide to make the product without go through the last perspective. If the answer instead is no, the cost analysis perspective must be brought into the analysis, where the lowest cost decide if make or buy is the right alternative (Brandes, 1994). This procedure is illustrated in Figure 15. Brandes (1994) model is easy to follow and is straight forward, but one major drawback exists for the model. The identification procedure of the three aspects core competence, dependency risk and lowest cost is not clarified. It is the same scenario for the other models found in the literature study.

![Diagram](image-url)
4 MODEL VERSION 1

Model version 1 is based on the theory described in the previous chapter. The procedure for model version 1 is described in this chapter. Notice, this is a draft version of the final model.

The first developed model in this thesis, model version 1, is a modified Brandes (1994) model. The modifications performed are the identification procedures for each perspective and the relationship aspect, illustration Figure 16. The reasons for the modification evolve from the literature study that detected relationship as an important factor for a successful outsourcing, and the lack of structured models that includes identification procedures. The first three steps in model version 1 are the same as Brandes (1994) presented in his model, besides that the core competence is change to core capability. Explanation of what Model version 1 includes is described below.

**FIGURE 16 MODEL VERSION 1**

### 4.1 Step 1 - Core Capability

Core competence is the knowledge or skills behind a product or a process that is special in the market and gives a competitive advantage. That to say, a product or a process is not core competence. However, it is a strong relation between the process and the core competence. The core competence together with a strategic process/activity creates the core capability (Long & Vickers-Koch, 1995). If the product will be outsourced the core capability must be passed on to the chosen supplier, otherwise they will not be able to deliver the product with a competitive advantage. Because of this, more companies than the outsourcing company knows their core capability. In that way, the core capability is an easier target to copy; when it has been copied, the competitive advantage will disappears. It is also important to know the core, core close and non-core activities in outsourcing decisions. Otherwise, the link between the core competence and the strategic process can be broken. To identify the core competence several methods has been presented; SWOT analysis, focused SWOT analysis, competence pyramid, and value chain analysis. Depending on the best suitable option for Cardo, one of these analyses will be used in the final version of the generic model. If the product affects the core capability of the company, it must be kept in-house and the make-alternative is chosen. If the core capability not is affected, risk has to be analyzed and this is described in step 2 below.
4.2 Step 2 - Risk

Researchers have identified several risks associated with outsourcing, rather few has defined any model in how to identify the risks. It is vital for companies to be aware of the risks linked to outsourcing. Of all the risks mentioned by researchers, only a few might be applicable on the make-or-buy decision, i.e. the risks must be evaluated on a situational basis. Examples of risks that can occur are; technical risk, relationship risks, commercial risks and loss of knowledge. If the risks are too high, the product must be kept in-house; otherwise, the costs must be evaluated in step 3.

4.3 Step 3 – Cost

Many researchers argue that costs are one of the key components in a make-or-buy decision. It is very important to cover all costs related to the decision and a total cost model is a good way of covering the costs. In a total cost model, the following cost elements are often included; carrying cost, manufacturing costs, facilities costs, transportation costs, overhead costs, and other costs. Furthermore, it is very important to allocate the correct costs to products. A suitable procedure to allocate costs is Activity-based costing (ABC). The basic concept behind ABC is that a company has resources that are used by activities. Cost objects, e.g. products, consume all these activities. If the total cost is lower in-house, the product is kept in-house, otherwise the buy alternative is chosen and a relationships analysis must be executed.

4.4 Step 4 - Relationship

In a relationship with a supplier, risks are always included. Therefore, it is important to evaluate the relationship a company and its supplier should have in an outsourcing collaboration. In this thesis four primary relationships are presented, which is nonstrategic transactions, contractual relationships, partnership, and alliances. Several methods to identify the most suitable relationship have been presented, all of them similar to each other, e.g. Kraljic’s matrix. The companies must identify the risk they are willing to take, depending on products and strategic importance.
5 PROBLEM SPECIFICATION

With a basis in model version 1, presented in chapter 4, each sub-area is divided into concrete questions. These questions give guidance throughout the empirical study and the analysis part of the thesis. These questions are also stated so that the gap between theory and empirical studies are decreased and to attach the two areas together.

5.1 EMPIRICAL STUDIES

The empirical study’s purpose is to find out more about Cardo’s view on outsourcing and how Cardo is dealing with make-or-buy decision. This section has the same structure as model version 1.

5.1.1 CARDO’S PRESENT MAKE-OR-BUY PROCEDURES

Since this is the first area of the empirical studies, the intention is to know how Cardo is dealing with the outsourcing issue today and what the employee’s point of view on outsourcing is. The question is rather generically formulated, as to not influence the answers of the respondent. The first main question is:

- How does Cardo work with the make-or-buy decision?

5.1.2 CORE CAPABILITY

During the interviews, it is important that the interviewer and the respondent perceive the meaning of the terms used in the same manner. If they do not, the interviewer has to clarify the terms for the respondent. In this case, core competence is a term that is hard to get a clear picture of and it therefore needs to be clarified. Two questions regarding core competence and its similar expressions core capability and core process/activity has therefore been formed.

- How are core- competence, capability, and processes/activity defined?
- Does the respondent differentiate core -competence, capability, and process/activity?

To compare literature with how the company identifies core competence it is essential to understand how the decision-making process is applied. The first information needed is whether core competence is incorporated as an aspect in a make-or-buy decision process. Otherwise, more specific questions regarding how they identify core competence will be unnecessary.

- Is core competence an aspect in a make-or-buy decision?

If the answer to this question is no, it is vital to understand why it is so because the reason could have important impacts on the make-or-buy procedure. If the answer is yes, the next step is to understand how they identify the company’s core competences. A core competence is challenging to define, which also makes it hard to identify. It is therefore important to understand exactly how they identify core competence.

- How are the core competence/capability/process identified?

It is important to know how Cardo work with the core and non-core competences, to be able to develop a model that suits Cardo, and to be able to identify vital faults in their procedure. To investigate how Cardo are working with products related to the core competence, an answer to the following question is needed.

- When a core competence is identified, what is the next step?

If the identification of core competence is not conducted with a structured method, it is essential to investigate why. This is to ensure that the model is suitable for the company.
• Why does not Cardo have a structured way of working?
• How does a structured procedure for make- or- buy decision for Cardo look like?

5.1.3 Risk

In the literature study, several risks linked to outsourcing were identified. These risks are important to take into consideration before an outsourcing decision is made. If risks are neglected, the possibility of failure or a non-satisfying result is greater than if the risks are known. To control if ABS and Crawford are aware of different risks related to outsourcing, the following question needs an answer.

• Is the company aware of the risks related to outsourcing?

If the answer is that they are aware of the mentioned risks, it is important to know what they mean by these risks and if they can manage the risks. This affects how the model should be constructed through the impact the risk has on the outsourcing decision. Therefore, the following questions need an answer.

• How are risks identified?
• Are the risks crucial for the outsourcing decision?
• Can the risks be managed satisfactorily?

5.1.4 Cost

As mentioned in chapter 3, it is important to consider costs when making a make-or-buy decision, therefore it is vital to find out if Cardo is taking costs into their decision making. If the answer is no, it is essential to find out why Cardo is not considering this.

• When taking make-or-buy decisions, is cost a part of the decision?
• If not: Why?

From the literature study a cost model was formulated, consisting of six elements, see Figure 17 below. This model is used because it is important to have insight into all the costs related to the outsourcing decision. Even though the model has to be reconfigured to each individual situation, it still provides an overview of the general elements that can be part of a cost model in the outsourcing decision.

<table>
<thead>
<tr>
<th>Total cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carrying costs</td>
</tr>
<tr>
<td>Facilities costs</td>
</tr>
<tr>
<td>Other costs</td>
</tr>
</tbody>
</table>

FIGURE 17 TOTAL COST MODEL

The model is used as support to find out how the calculations for make-or-buy decisions are performed. To find out if any of the cost elements are considered in make-or-buy analysis, the question below is asked:

• When building a cost model in a make-or-buy decision, what cost elements are included in the present calculations?

When taking the cost elements into the model, it is crucial to find out how the costs are allocated to the products / components.

• How are the costs allocated to the product / component?
5.1.5 RELATIONSHIP

The relationship with a supplier is vital for a successful outsourcing. As seen in chapter 3 the type of relationship depends on the strategic importance of the product and the degree of standardization. Furthermore, the risk linked to outsourcing will also be lower if the right relationship is chosen. To be able to compare theories with how Cardo is performing today, and to be able to give guidelines for the choice of relationship the following question is stated:

- Does a method for supplier relationship choice exist?

5.2 COMPARISON OF THEORY AND EMPIRICAL DATA

The aim of this section is to identify the areas where Cardo performs satisfactorily and in which areas they do not, compared with theoretical approaches. When this is clarified, the process of constructing a model with both inputs from Cardo and from theory is initiated. The main questions here are therefore:

- Compared with theory, what is Cardo doing satisfactorily in the present situation?
- Compared with theory, what is Cardo doing less satisfactorily in the present situation?

If Cardo performs satisfactorily in the present situation, Cardo’s way of working is used in the model as well. By doing this, the best from the theoretical approaches and Cardo’s best practices are combined into the model called version 2.

5.3 MODEL EVALUATION

In this step, the goal is to test model version 2 and to exemplify how the model version 2 should be used. To do this the model is handed to different purchasers, category managers etc. They get the opportunity to read the model and see how usable it is. Therefore, the questions below must be answered:

- Is the model suitable for Cardo to use?
- Is the model generic?

After this, the users will give their opinion on how the model can be improved that is the input to model version 3.
6  METHODOLOGY

This chapter describes the methodology from the purpose in chapter 1 all the way to the generic model version 3 is created. To fulfill the purpose the structure in Figure 18 is followed. It is explained in chronological order, theoretical study, empirical study, comparison of the theory and empirical data, and last the methodology for the model evaluation is described. The chapter ends with criticism of sources and methodology.

6.1  THESIS WORK METHODOLOGY

When reality is explained as objectively as possible with a holistic approach where synergy effects and correlations between different parts in a system are in focus, it is called a systems approach. A systems approach is focused on understanding correlations and links to reveal underlying reasons for a behavior in a system (Björklund & Paulsson, 2003). One example can be how cost savings in one part of a company can make a cost increase in another part. Therefore, this thesis has a systems approach thus links and correlations for a behavior will be revealed. The thesis structure presented earlier in section 1.4 and shown in Figure 18 below is in line with a deductive procedure. A deductive procedure is when the theories first are searched and then to be verified in an empirical study, i.e. the theories functions as foundation for the empirical study (Björklund & Paulsson, 2003).

![Thesis Work Methodology Diagram](image)

6.1.1  THEORETICAL STUDY

The literature study’s first purpose was to get a broad picture of the issues in make-or-buy /outsourcing decision. The study was in that manner descriptive in this phase due to the basic knowledge from university studies (Björklund & Paulsson, 2003). The methods for the first phase of the literature study consisted of book searches in the library catalogue of both Malmö University and Malmö City library. Furthermore, through searches of old/previous master thesis in the Diva database, see (Linköping university electronic press). These books gave the broad picture and more relevant sources, which narrowed the picture to more relevant theories for make-or-buy models. This is illustrated in Figure 19.

The specific theories brought the literature study into the explanatory phase, where a deeper knowledge is comprehended and the desire to understand and describe the theories exists (Björklund & Paulsson, 2003). The method to get theories that are more specific was through the book’s sources that referred to other books and articles in the subject. This method has been used throughout the whole literature study. To find more theories the databases Business Sources Premier and Emerald has been used. These searches have been restricted, firstly to scholarly previewed and full text. If too many hits were generated a more restricted search was done,
with too many means at least over 100. During these searches, same hits where often generated in both Business Sources Premier and Emerald. Business Sources Premier had better search alternatives, therefore was mostly Business Source Premier used as a database. The searches are documented in Appendix A, where search words etc. are shown.

<table>
<thead>
<tr>
<th>Descriptive Phase</th>
<th>Explanatory Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Broad Picture</strong></td>
<td><strong>Narrower Picture</strong></td>
</tr>
<tr>
<td>Books &amp; Master Thesis</td>
<td>Books &amp; Articles</td>
</tr>
<tr>
<td><strong>Library &amp; Diva</strong></td>
<td><strong>Business Source &amp; Emerald database</strong></td>
</tr>
</tbody>
</table>

**FIGURE 19 PROCEDURE FOR THEORETICAL RESEARCH**

The broad picture gave an indication of the scope of the subject outsourcing, and to map which aspects that were most relevant to use in an outsourcing framework a table was created. This table summarized what aspects each author highlighted, see Table 1 in chapter 3. The most common aspects were core competence, risk, relationship, and cost. These four established the base for the development of the generic make-or-buy model. To find more specific information on those subjects, a study in the databases was performed again, the information searched for were firstly on how to identify the aspects and secondly how they were defined. The construction of model version 1, as mentioned above, evolved from the literature study that identified several models for make-or-buy decision. The chosen model had to be easy to follow and straightforward, which most of the models did not fulfill. Brandes (1994) presented a model that was straightforward and easy to follow, but it needed to be complemented with how each perspective should be identified. The theories presented in chapter 3 were therefore included in the model, and the relationship aspect that were identified as a critical aspect for a successful outsourcing. Model version 1 and the highlighted aspects were compared with how Cardo performs their outsourcing decisions today. Therefore, model version 1 constituted the base for the empirical study of the thesis.

### 6.1.2 EMPIRICAL STUDY

The option to visit both ABS and Crawford factories, and meet people responsible for make-or-buy decisions was an opportunity for the empirical study. Interviews were the most suitable option for empirical data collection, because of the option to visit the responsible people. Interviews makes the validity stronger thus, the possibility to make sure that the respondent understand the question that are asked. In this case, the formulation of questions for e.g. survey is hard to develop so people that will answer understand the meaning of the question. The interviews were in a structured from; i.e. the questions were prepared before the interview (Björklund & Paulsson, 2003). This in combination with a semi-constructed form of interviews meaning that if the respondent brought up interesting aspects during the interview questions where formed as the interviews went along. (Björklund & Paulsson, 2003). This procedure is also in line with Mertens Oishi (2002) that argues for interviews when questions are complex and hard to formulate. Generally, the first question should be in interest for the respondent and easy to answer. They should be related to the topic not their position in the company (Mertens Oishi, 2002).

The empirical study was conducted from five different factories that belonged to two different divisions of Cardo. The reason that only four factories were included in the study depended on the lack of time to perform a study at all factories in Cardo. Instead, the layout of this thesis is developed for the possibility to complement with more empirical studies to improve the generic model. The supervisor in Cardo chose factories in Europe, because he has the understanding and familiarity of the factories and in that manner, he is able to choose the most suitable factories for this study. One factory in the ABS and three in the Crawford was chosen, which
represent both companies well considering products and production capacity. The reason of the significance of information should to be from both ABS and Crawford, and being representative is that the model should be generic. Generic in this thesis has the sense that the model is suitable for all Cardo’s products.

Moreover, the interviews were prepared to give a useful result this through two steps, illustration Figure 20. First a pre study, which was performed with people from both Crawford and ABS working at Cardo’s headquarters. The purpose was to give an indication if any structure or methods for make-or-buy decisions existed in Crawford and ABS, but also give a strategic view over make-or-buy decisions. As mentioned earlier, the theoretical study was the foundation for the empirical study and for that reason; the questions addressed in chapter 5 functions as a guide for the empirical study. Before these main areas were controlled, more open questions about Cardo’s make-or-buy process were addressed. If this had not been the case, the possibility to influence the answers had been greater and the objectivity would then have been worse. Objectivity is described as; which extension the interviewer’s way of thinking in the subject influences the answers of the respondent (Björklund & Paulsson, 2003).

![Figure 20 Procedure for Empirical Study](image)

**Figure 20 Procedure for Empirical Study**

To be able to get information from different angles, people from different departments and different hierarchies were included in the interviews. The following positions were included in the empirical study at the factories: site manager, purchasing manager, quality manager, production manager, controller or financial manager, and research and development manager. This is only people from management positions. The reason for this is that an outsourcing decision is a strategic decision, which then includes the management. They are responsible for the outsourcing process and have the knowledge of the process. They know which people that is included in the process etc. Therefore, it is enough to interview these people and not lower level staff. At the headquarters, the persons interviewed included: the vice presidents of supply chain for entrance solutions and for flow solutions, vice president of purchasing for direct material and logistics, and director of organizational development.

To increase the validity, the first questions make sure that the terms used had the same meaning for both the interviewer and respondent. Validity is in which extension the measured is to the intended to the measure (Björklund & Paulsson, 2003). The purpose for the empirical study is to verify the theoretical models and findings with Cardo’s procedure for make-or-buy decisions. Of this reason, the question has been formulated from the question addressed in chapter 5 in combination with more specific questions regarding the theoretical models identified in the literature study. The questions in chapter 5 are on a general level, which means that they are hard to get an answer on without asking sub questions. These sub questions are linked to the theoretical models and findings from the literature study, to be able to compare theory with reality. Moreover, it is always important to understand why the company is doing as they do. Therefore, answers where always followed by the question why. If ABS and Crawford did not have a structured method to work with the questions were formulated for that case as well. These questions were formulated for understanding why and how they wanted to work. The latter is also important to understand to be able to develop a make-or-
buy model for Cardo. During the interviews, interesting findings that needed more investigation were found. To get this information, the responsible persons for that specific topic were contacted again, through e-mail or through a meeting where the respondent could sit down with us and explain systematically how it worked. E-mails were sent when the additional information needed not was complex to ask questions about and to answer, when the case was more complex the procedure was a meeting.

6.1.3 COMPARISON OF THEORY AND EMPIRICAL DATA

Both, the empirical data collected from the interviews and theories from the literature study were compared to develop a generic make-or-buy model, illustration Figure 21. If the empirical data and theoretical procedures were a match, they were included in the make-or-buy model. If the theory and empirical data did not match but Cardo’s procedure was acceptable, Cardo’s procedure was implemented in the model. This increases the chance that people in the organization will use the model. Furthermore, if ABS and Crawford had different procedures or if one of the companies had an acceptable procedure the model’s purpose were to take the best procedure into the model so both companies were using the same procedures. If no match between theory and empirical data existed and not any acceptable structure was used, an investigation about why and how the procedure should be developed to fit Cardo was performed. The result of this investigation was implemented into the model. A reason for these procedures is that Cardo easier can work with a model that are similar with their present procedures, than working with a complete new procedure that ends up with similar result. The actions between theory and empirical data created model version 2.

FIGURE 21 MODEL VERSION 2 CREATION PROCEDURE

6.1.4 MODEL EVALUATION

To control if model version 2 was generic and suitable for Cardo, future end-users reviewed the model. This involved six persons in the following positions; category managers, purchaser, factory manager, production manager, vice president of purchasing, and risk manager. Furthermore, the supervisor and discussants at the university reviewed the model. If external developers involve end-users in the development of a model, the model will be user-friendlier (Hägg & Wiedersheim-Paul, 1994). Furthermore, a model should not include systematic errors or incorrect parameters (Wallén, 1996). Therefore, the focus of the review was on how user-friendly the model is, and if the model gives enough and correct information. To perform the model evaluation, the respondents were contacted and provided with model version 2. To evaluate the model, telephone conferences were held, where the respondents were given an opportunity to come up with suggestions for improvements. The outcomes of the review were evaluated and integrated to model version 2, see Figure 22. Because few persons were interviewed, it was challenging to control if more persons had the same opinion or if it was just one persons opinion. Furthermore, since the interviews were conducted continuously, the last respondent’s opinion was difficult to triangulate. Therefore, the opinions of persons on a division level were seen as more relevant, if two suggestions were the opposite of each other. The questions asked were semi-constructed, to give the respondent the opportunity to provide their opinion. The prepared questions purpose was to control that all decried information were collected. The evaluation questions are presented in Appendix E.
6.2 CRITICISM OF METHODOLOGY

According to Björklund & Paulsson (2003) a method can be questioned with base in three qualities: reliability, validity, and objectivity. Reliability is defined as the degree of reliance in the measurement instruments, i.e. what is the probability of getting the same result if the research is done again. Validity tests if the instruments used measures what they intend to measure. Objectivity is how explicit the selections are motivated and declared to the reader. This way of measuring the credibility is also supported by Lekvall & Wahlbin (2001).

6.2.1 RELIABILITY

A high reliability is secured via specific questions, triangulation of data plus questions that is stated in the same way. After the theoretical study was conducted, four main areas were found. These areas were the foundation of the empirical study and the questions was stated in such a way that they answer the most fundamental issues within each category. This contributed to a higher degree of reliability.

To make the model more user-friendly, the performed model evaluation should have included more respondents to be able to triangulate to most significant improvements. The issue with the present procedure is that one person’s opinion cannot be verified with all respondents. The reason that the model evaluation not included more interviews depended on the lack of time. This will lower the reliability of the thesis because other end-users might have come up with other aspects to change.

6.2.2 VALIDITY

Since the supervisor at Cardo has been reviewing the thesis continually during the work, it will improve the validity of the thesis. The reason for this is that the supervisor has a wide knowledge about Cardo’s procedures and could therefore help to point out directions for suitable questions. When the interviews had been performed and summarized each person interviewed was contacted through email, where the interview was summarized. The purpose with the procedure was to secure that we had understood everything correct and give the respondent a chance to change to context if something not was true.

6.2.3 OBJECTIVITY

The objectivity of the empirical data can be questioned, because it is based on interviews and the answers from a respondent depends on who is asking the questions and how the questions are asked. Another problem with interviews is that it may be problems to interpret the answers, and the interpretations might be different from person to person. Since the respondents received a summarization of the interviews, they could review the data and confirm that no misunderstanding took place. This will make the objectivity of the thesis higher.

6.3 CRITICISM OF SOURCES

The theories are from books and articles written by researchers. It is important to know that all written literature is secondary data and therefore not specific for the thesis. Another important aspect is that all theories derived from research and is reviewed by other researchers and can therefore be considered as scientific. The focus of the theories is on outsourcing and the make-or-buy decision and all the models found are not just for manufacturing but also for service. The four main components chosen are highly interesting for the make-or-buy decision for products. Even though many of the sources are more than 10 years old, they can still be considered relevant.
Since most of the empirical data in the thesis derives from interviews these data are primary, which means that it is specific just for this situation. One problem that might occur with this data is that the respondents are trying to flatter the situation. To get around this problem are several different people interviewed on different locations to get their view of the problem and in this way, the data was triangulated.

The empirical study had its focus at Crawford since just one of four factories visited was an ABS factory. The respondents at the headquarters had mostly their main responsibility in Crawford. To improve the model more input from ABS could make it more generic, because ABS products are not in the same segment as Crawford. The reason this was not performed depended on the time aspect and possibility to meet the right people. Therefore, the supervisor suggested the studied factories.

The fCRT and EFR tools are developed in other books or articles were either not found or missing authority to download them. Two of the sources not found were written by the authors of the article that used the fCRT and EFR tools, which makes the article used to a relative safe source. A third source Goldratt (1994) where they used the theory of constraints (TOC) was not found in the library and no access available in the database.

In the analysis of each main aspect, the focus was not to go deep. Instead, focus was on how the aspects were correlated to each other. If each aspect had been investigated more, each aspect could include more inputs for the decision. Instead, less input is used in the model, which makes it easier to understand the correlation between each aspect and it provides a better overview over the problem in make-or-buy decision. This makes it easier for a company to use the model, which is better than not use any model at all.
7 EMPIRICAL STUDY

The empirical study chapter starts with a description of the sites visited. The chapter continues with a presentation of interesting findings in the four main areas: core capability, risk, cost, and relationship.

7.1 SITES VISITED

As mentioned in chapter 6, four different sites and the headquarters of Cardo have been visited with the purpose to gather information about present make-or-buy procedures in Cardo. On each site, information has been acquired through interviews; the respondents have been people involved in the make-or-buy decisions. These are plant managers, production managers, purchasing managers, financial controllers, quality managers, and research and development managers. Each factory’s production and present outsourcing procedure are explained below.

7.1.1 SITE A

Site A produces residential garage doors, which is the only site visited that focuses on the consumer market. The products are garage-doors, in a number of different colors and coatings. The production process is constructed to be more or less an automatic production line; therefore, little manual work is performed. However, a few special operations are conducted manually, but this amounts only to a small volume each year. A whole garage-door is finally packed in a special package in the factory, containing everything needed for the customer. No production is started unless there is a customer who has already placed an order, i.e. the production follows customer orders. Site A does not have a companywide outsourcing procedure. Instead, it is done on a situational basis.

7.1.2 SITE B

In Site B, a wide spectrum of pumps operating mostly in dry environments is produced, where approximately 70% of the turnover comes from the pulp and paper industry segment. The demand for different pumps varies from two per year to thousands per year. The production follows customer orders, and all products are specially developed for customers. One special thing in the factory is the test station where all pumps can be tested and adapted for each customer. Because of the customized products, it is hard to automate the whole production that also contains manual workstations. A special flow for long items, such as mixers, is in place to minimize the internal transportation in the factory. The present procedure for outsourcing decisions at Site B is summarized in the seven-step bullet list presented below.

1. Decision of interesting components to outsource
2. Sending drawing to suppliers
3. Get quotes
4. Calculate MA price
5. Compare MA price with quotes.
6. Visit the suppliers
7. Take the decision

Interesting components for outsourcing in Site C has usually high volume, where technician plus purchasing investigates and presents decision material.

7.1.3 SITE C

In this factory, industrial doors are produced. The factory is divided in two sections: manufacturing of panels and manufacturing of parts needed to operate the door and to assemble the doors on site. These two sections of the factory are merging in the middle, where trucks are loaded and deliver the products to customers. The panel-line is automated, with exception of the painting of non-standard colors and doors of special dimensions. These exceptions are only representing five percent of the total volume. Special for the factory is the
production of springs. The spring-production makes it possible to optimize the spring for every garage door, which also makes it possible to have short lead-times to the aftermarket.

The present outsourcing process first considers costs and then strategic issues, e.g. core businesses and flexibility. No standardized procedure for outsourcing decisions exists. Instead, it is rather questions followed by discussions and group meetings for outsourcing decisions. If a component is interesting to outsource after the discussions, calculations are performed. This is more common sense than a model/procedure for outsourcing decisions. Depending on the impact the decision has, a team will consist of different people. If there is a small impact, just production and purchasing investigate the outsourcing analysis, when it has a larger impact more departments are involved.

### 7.1.4 SITE D
This spare parts center consists of a show room, a warehouse, a small production and assembly facility. From site D, the service technicians are supplied with the spare parts needed. The spare parts center is highly automated with orders coming into the ERP system and after this the production can be executed, which can consist of cutting of panels in correct lengths, corrections of springs or picking of components. An interesting aspect is that they also have competitors’ panels in stock, in order to be able to perform service on competitors’ products.

In Site D most of the outsourcing decisions are made from experience and if the site is suitable for the component or not. The aspects that they consider is: can the machines in the factory handle the component, is there a small volume and how technical complex is the component. An example of this is the picking activity of rare components from boxes within the factory to boxes that will be sent to customers. One person handled the components with low demand. If the volume of the component increased new employment is necessary, the component will instead be outsourced.

### 7.1.5 SITE E
Site E is the headquarters of Cardo. The people interviewed are involved in the top management of the matrix organization described in chapter 2. This includes the vice presidents of supply chain for entrance solutions and for flow solutions, vice president of purchasing for direct material and logistics, and director of organizational development.

At Site E, different procedures are applied in different divisions and for different decisions. One respondent investigated outsourcing to simplify the flows, because it is important to focus on a few selected activities to get increased profitability. There is also a historical perspective, it takes time to change an old view that exists in traditional manufacturing units, because they want to produce everything by them self. On a division level, Cardo determines which activities that they invest in. Indirectly, the investments makes the factories reflect upon outsourcing as an alternative to get profitable in the activities not invested in. Another procedure for outsourcing starts when there is lack profitability in an activity. Other alternatives are then investigated and in this way, outsourcing is generated from the profitability. If the company brand is outsourced, it is important to protect it and secure a high quality in the whole supply chain. In these decisions, the profitability steer the decision, which makes it important to have good agreements.

### 7.2 CORE CAPABILITY
During the interviews, the respondents had different answers on what core competences are for the company, this also varied depending on which site the questions were asked and in what level of the organization the respondent was active. In the factories, a similarity was the focus on what the specific site is good at. Examples of mentioned core competences/activities are knowledge in producing, the possibility to produce customized products, good product quality, on time delivery, and panel line. However, site D differentiated; they saw it as knowledge, distribution network, and service.
Notifiable is that the factory managers had a strategic view on the outsourcing decision and a better connection to the business strategy than other respondents did. One factory manager argued that the core competence must come from the statement of direction that the top management provides to the factories. Moreover, the respondents also wanted to get directives on what the core competence is from top management. In some cases, it was expressed that there is a lack of communication when it comes to what the core products and components are. However, the top management argues that the sites have a responsibility to benchmark against competitors to reveal what makes each site is unique.

There is no structured procedure to identify the core competences in the organization. Instead, core competence is identified through experience, knowledge, company culture, and trends. The reason is explained by respondents as historical; it is how it always has been done. The respondents did not suggest any better procedure to indentify Cardo’s core competence. To transfer the business strategy from corporate level down in the organization, statement of directions is used which is explained later in this section. Site A and C ordered products from their competitors to be able to benchmark the competitors' production against their own. This is not performed on a regular basis.

In site E, core competence is analyzed on a strategic level. One respondent argued that to decide what the core competences of the company are should originate from the business strategy. It is also very important to take the core competences in consideration when investigating outsourcing. Another respondent argued that the discussion about core competence is hard and often ends up outside the topic. To be able to set the focus on a qualitative level in the discussion, the respondent had worked with a model in another company. This model helped as guidance in the discussions to focus on the main areas instead of the smaller issues.

**Strategic documents**

Cardo has seven points as strategic goals for the organization, presented in chapter 2. To translate what the strategy means for each division, a statement of direction for each division is created, see Figure 23 below.

![FIGURE 23 STRATEGIC STRUCTURE AT CARDO](image_url)

The seven points are the base of the strategy for Cardo, these are spread throughout the organization via intranet, documents and presentations. There is a lack of discussion about the link between core competence and business strategy for the statement of directions. Furthermore, there is no overall picture of the strategic initiative from the top to the bottom within the organization. The top management is aware of this and working hard on the learning process within the organization. To enhance the learning process, Cardo is using an executive program to translate the strategy into the daily business. In this thesis, Crawford and ABS are investigated therefore the statement of direction for these are presented more in detail.

The statement of direction for Crawford outlines how Crawford can work in the same direction. It is also stated threats and opportunities on the way to achieve the strategy. This is translated into five strategic areas that should be fulfilled to achieve the strategic goals. Interesting to notice from the statement of direction is that outsourcing is mentioned as an opportunity for the future.
ABS’s statement of direction is briefer than Crawford’s statement of direction. ABS wants to be a company that offers valuable solutions to selected customers, to whom they can have a long and close relationship with. To achieve that, there are two different activities in the market: direct sales and indirect sales, which will be achieved through innovational, commercial and operation excellence. In these three areas, ABS has stated how they have to change to achieve their strategic goals. Interesting to notice is that ABS has stated that the global strategy has to be transformed into daily business.

7.3 Risk

Respondents have their own thoughts about risk and what risks worth considering in an outsourcing decision. Several risks are more commonly mentioned, such as, financial risk, quality risk, and delivery risk. Financial risks are often mentioned in combination with a supplier, e.g. the risk that the supplier goes bankrupt and not being able to deliver the products. To handle the financial risks, Cardo has implemented significant supplier audits, which is presented more in detail later in this section. Another commonly mentioned risk is the quality risk, especially the quality of the products delivered to the factories. This risk is handled with different procedures, depending on site; site A performs supplier audits and controls incoming goods with different quality parameters. Site B buys processed material in several cases to handle quality risks, because quality issues occur when the material is processed. These quality issues are notified in the supplier’s production, in that way site B does not need to send faulty products back to the supplier. Site C is securing the quality by letting the supplier have access to their knowledge and do supplier audits. Site C also has a risk management program that is supposed to take into account the risk of a catastrophe (e.g. earthquake, flood, and fires). Site D has mostly internal suppliers, which means that quality risk is a minor problem. All sites argue for the importance of delivery risks, which is the risk of the supplier not being able to deliver the right products at the right time. This is dealt with in by safety stock or in safety lead times.

Other mentioned risks are the risk of losing knowledge in the company, the power-dependency risk towards the supplier, investment risk, risk of double costs and worsen competitive strength. The risk of losing knowledge in the company is not considered as a major risk at site A, C and D because they are only producing standardized products, which not demands advanced knowledge. It is not difficult to find persons being able to do this work. On site B, they are more aware of the risk of losing knowledge; they argue that it is important to keep the knowledge on how to produce the products within the company. On site E, they argue that it is important to keep the knowledge that is close to the core activities within the company. Site E consider risks from a strategic perspective, and are therefore focusing more on risks related to a longer time-perspective. Moreover, they are also trying to cover risks that are harder to quantify, such as knowledge, technology-innovation, and power dependency risks. The investment risk is when Cardo invests in new machinery and does not get the forecasted volumes. Double costs occur if Cardo not successfully removing the old machinery when buying new. Another mentioned risk is the weakened competitive strength, which can occur when manufacturing in-house, and then loose the connection to the latest technologies.

One important remark is that Cardo has no structured companywide procedure to work with risk related to outsourcing, except the supplier assessment tool that is used throughout all divisions. It is also worth mentioning that Cardo does not differentiate between the strategic importance of the product and the risk involved with outsourcing decisions. Below, a more detailed description of the supplier audit (SA) is presented.

The reason for having the SA, is to have a standardize procedure throughout the whole company. In this tool, Cardo has eight different perspectives to investigate a supplier: Quality & Environmental system, Business, Design Technology, Production Technology, Process, Training, Materials management, and Sustainability. Each perspective is divided into different areas that are weighted towards each other. Each sub-category is given points from zero to four. These points are multiplied with the weighted percentage and summarized to give the perspective a score. The supplier must have an average over 2,25 points per perspective and a minimum of 175
points in total. If the supplier does not have this, an action plan is applied to correct the activities that are not appropriate. The SA has to be conducted on all of Cardo’s suppliers.

**Quality & environmental system**

Within the quality & environmental system category, Cardo is identifying how the supplier handles the quality and environmental issues and how they manage these issues. The sub categories that have the highest weight are customer field return rate (warranty), management responsibilities and internal auditing of quality environmental procedure system, see Table 3.

<table>
<thead>
<tr>
<th>1.0 Quality &amp; Environmental System</th>
<th>Weighting percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 ISO9000/ISO14000/ISOTS16949</td>
<td>5</td>
</tr>
<tr>
<td>1.2 Internal Auditing of Quality Environmental Procedure System</td>
<td>15</td>
</tr>
<tr>
<td>1.3 Product and Production Document Control</td>
<td>10</td>
</tr>
<tr>
<td>1.4 Quality System Software Tools</td>
<td>5</td>
</tr>
<tr>
<td>1.5 Benchmarking Improvement Results</td>
<td>5</td>
</tr>
<tr>
<td>1.6 Customer Field Return Rate (Warranty)</td>
<td>20</td>
</tr>
<tr>
<td>1.7 Failure Analysis Capability</td>
<td>10</td>
</tr>
<tr>
<td>1.8 Quality Management</td>
<td>10</td>
</tr>
<tr>
<td>1.9 Management Responsibilities</td>
<td>20</td>
</tr>
</tbody>
</table>

**Business**

The most important aspects within this category are debt ratio, percent of suppliers revenue derives from Cardo and business disaster recovery plan. It is vital to know how the supplier’s business is today and in the future.

<table>
<thead>
<tr>
<th>2.0 Business</th>
<th>Weighting percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 Business Disaster Recovery Plan</td>
<td>20</td>
</tr>
<tr>
<td>2.2 Capacity Planning</td>
<td>7,5</td>
</tr>
<tr>
<td>2.3 Internal Information Systems Support</td>
<td>5</td>
</tr>
<tr>
<td>2.4 Turnover (P&amp;L)</td>
<td>0</td>
</tr>
<tr>
<td>2.5 Debt Ratio</td>
<td>30</td>
</tr>
<tr>
<td>2.6 Percent of Supplier’s Revenue is Cardo</td>
<td>20</td>
</tr>
<tr>
<td>2.7 Housekeeping and Safety</td>
<td>10</td>
</tr>
<tr>
<td>2.8 RMA Cycle Time</td>
<td>5</td>
</tr>
<tr>
<td>2.9 Employee Turnover Rate</td>
<td>2,5</td>
</tr>
</tbody>
</table>

**Design technology**

The most significant sub-categories involve the calibration of design lab test equipment and how the supplier introduces new products to the market. However, the weighting is rather even between the different sub-categories.

<table>
<thead>
<tr>
<th>3.0 Design Technology</th>
<th>Weighting percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1 Early Supplier Involvement Process</td>
<td>10</td>
</tr>
<tr>
<td>3.2 Calibration of Design Lab Test Equipment</td>
<td>15</td>
</tr>
<tr>
<td>3.3 New Product Introduction Process</td>
<td>15</td>
</tr>
<tr>
<td>3.4 Design Evaluation Tools</td>
<td>10</td>
</tr>
<tr>
<td>3.5 In-House Tooling Capability</td>
<td>5</td>
</tr>
<tr>
<td>3.6 Product Reliability Program</td>
<td>10</td>
</tr>
<tr>
<td>3.7 Product Qualification/Certification Process</td>
<td>10</td>
</tr>
<tr>
<td>3.8 Data Transfer</td>
<td>10</td>
</tr>
</tbody>
</table>
Production technology
This category includes the production equipment and the handling of the equipment. Each sub-category is equally important.

### 4.0 Production Technology

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Weighting percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1 Equipment Condition</td>
<td>25</td>
</tr>
<tr>
<td>4.2 Tooling storage</td>
<td>25</td>
</tr>
<tr>
<td>4.3 Capable Equipment for Production</td>
<td>25</td>
</tr>
<tr>
<td>4.4 Production Software</td>
<td>25</td>
</tr>
</tbody>
</table>

**Table 6 Production Technology**

Process
Most of the sub-categories are equally important, but two of the highest rated are statistical process control and defect tracking / reporting. Both these categories consider the quality of the products and the ability to secure a high quality.

### 5.0 Process

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Weighting percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1 Work Instructions</td>
<td>10</td>
</tr>
<tr>
<td>5.2 Process Set-Up Checklists</td>
<td>5</td>
</tr>
<tr>
<td>5.3 Statistical Process Control</td>
<td>12</td>
</tr>
<tr>
<td>5.4 Process Capability Cpk</td>
<td>9</td>
</tr>
<tr>
<td>5.5 Preventive Maintenance</td>
<td>9</td>
</tr>
<tr>
<td>5.6 Product/Process Change Control</td>
<td>9</td>
</tr>
<tr>
<td>5.7 Calibration of Factory Test Equipment</td>
<td>9</td>
</tr>
<tr>
<td>5.8 Defect Tracking / Reporting</td>
<td>12</td>
</tr>
<tr>
<td>5.9 Non-Conforming Material Handling Control</td>
<td>8</td>
</tr>
<tr>
<td>5.10 Cycle Time Reduction Program</td>
<td>6</td>
</tr>
<tr>
<td>5.12 Warehouse</td>
<td>6</td>
</tr>
</tbody>
</table>

**Table 7 Process**

Training
Within this category the supplier’s educational programs is covered, which also is the most important sub-category. The other two sub-categories cover the employee’s possibilities for job rotation and their educational level in manufacturing.

### 6.0 Training

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Weighting percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1 Employee Training</td>
<td>50</td>
</tr>
<tr>
<td>6.2 Cross Training/Job Rotation</td>
<td>20</td>
</tr>
<tr>
<td>6.3 Manufacturing Operations Training</td>
<td>30</td>
</tr>
</tbody>
</table>

**Table 8 Training**

Materials management
In this category, the following areas are considered; the supplier’s subcontractors supply base control, and the supplier’s on-time delivery. Other important aspects that are controlled include how the supplier is handling their inventory, forecasting etc.

### 7.0 Materials Management

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Weighting percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.1 Supplier’s Supply Base Control</td>
<td>10</td>
</tr>
</tbody>
</table>

**Table 9 Materials Management**
7.2 Subcontractors 10
7.3 Forecast 5
7.4 EDI Capability for Customer Shipment Requirements 2.5
7.5 Material Handling Control 10
7.6 Material Planning System 5
7.7 Work in Process Inventory Management 5
7.8 Supplier Inventory Turns 5
7.9 Supplier On-Time Deliveries 10
7.10 Purchased Material Qualification & Certification 5
7.11 Supplier’s Internal, Proactive Cost Reduction Programs 7.5
7.12 Open Book Accounting 7.5
7.13 Material Control Traceability 7.5
7.14 Quick Turn Delivery 5
7.15 Bar Code Labeling 5

TABLE 9 MATERIALS MANAGEMENT

Sustainability
This category considers how the supplier is handling sustainability issues.

8.0 Sustainability Weighting percentage
8.1 Environmental Control Program 20
8.2 Employee organizations 20
8.3 Special regulations/ Legal aspects 20
8.4 Social aspects 20
8.5 Incidents / Accidents 20

TABLE 10 SUSTAINABILITY

These eight perspectives are accompanied by financial reports from Dun & Bradstreet that cover the economical point of views on the supplier. Firstly, the supplier’s strength is investigated and given a risk indicator value reaching from one to four. This risk is benchmarked against the industry competitors that provide an overview of the supplier’s status. The report also consists of payment behavior, called paydex, and of D&B failure score. The paydex indicates how often the supplier pays within time and the D&B failure score is a value reaching from 1-100, where 100 is low probability of bankruptcy and 1 is high probability of bankruptcy. The report also gives a summary of the balance sheet of the supplier.

7.4 COST

All sites agree upon that cost is one of the most important aspects when considering make-or-buy. The different sites argue for the importance to cover the total cost of the decision. The different sites have different ways of calculation costs: the costs they calculate are unit cost that in general consists of direct material and direct labor plus a factor to cover other costs.

In a few cases, people have taken more costs into their calculations such as transportation cost, payment terms, and reclamation cost. Site A has this covered in their factor and site C has parts of the transportation costs covered in their logistics cost. Almost every respondent wants to consider all costs when taken make-or-buy decisions. The reason that they choose not to is the difficulty to get all the necessary information and to quantify the different aspects. There is also a historical perspective to take into consideration. The historical perspective means that site A, B, C & D have a production focus and unit cost has always been used.

Site C wants to focus on the supply chain cost to find out where the costs arise and to be able to eliminate the so-called low hanging fruits. When investigating the total cost of the decision, it is important to search for what the best is for the whole supply chain. The employees in Site E have a total cost perspective, but there is no
standardized procedure to quantify the costs related to the decision. They all agree that it is important to cover the costs related to the decision. At site A, they are about to introduce a full cost model, which is supposed to cover the total cost, therefore a more detailed study in this area has been performed.

### 7.4.1 Full Costs Calculation

The full cost analysis will be implemented during 2010 in all divisions and companies within Cardo, and will be in use during 2011. Historically, the focus in cost calculations has been in unit costs. The purpose with the full cost model is in line with the new organization of Cardo that have more of a system approach. The first step in the implementation is to implement the full cost approach on all sites. The second step is to arrange cost allocation keys, to allocate the correct cost to the items manufactured. The costs included in the full cost model are summarized in Table 11.

<table>
<thead>
<tr>
<th>Cost</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct labor</td>
<td>Direct wages in production</td>
</tr>
<tr>
<td>Direct material</td>
<td>A standard price on incoming products including purchasing price. Note that the purchasing price can include transportation and packing cost from the supplier.</td>
</tr>
<tr>
<td>Direct logistics costs</td>
<td>Cost for goods reception personnel and distribution personnel. If the people working in the goods reception also handle the outgoing goods this is also included and if the outgoing goods is handled in a separate function this is included in the price.</td>
</tr>
<tr>
<td>Direct installation costs</td>
<td>Installation cost, which includes service peoples wages and materials costs etc. Cost to install product to customers.</td>
</tr>
<tr>
<td>Direct service costs</td>
<td>Cost for service technician</td>
</tr>
<tr>
<td>Variable manufacturing costs</td>
<td>This is all variable costs connected the manufacturing, e.g. electricity, gas, cost of heating, clothes for blue collar workers etc.</td>
</tr>
<tr>
<td>Variances from standards</td>
<td>Variation between budget and actual manufacturing costs. This is a standard value.</td>
</tr>
<tr>
<td>Inventory adjustments - other</td>
<td>Cost difference from budget in inventory, and obsolescence in inventory.</td>
</tr>
<tr>
<td>Price difference in inventory</td>
<td>Currency changes from budget, all products have buying value in inventory.</td>
</tr>
<tr>
<td>Quality costs</td>
<td>Quality handling costs, e.g. personnel wages. Quality defects in production. Return costs from customers</td>
</tr>
<tr>
<td>Variable sales cost</td>
<td>Depending on which supply chain the product is sold in. Reductions in prices, e.g. customer buy large quantities.</td>
</tr>
<tr>
<td>Capacity cost, G&amp;A</td>
<td>Overhead cost for each department, i.e. how much of the department cost should be transferred to the product.</td>
</tr>
<tr>
<td>Capacity cost, marketing</td>
<td></td>
</tr>
<tr>
<td>Capacity cost, sales</td>
<td></td>
</tr>
<tr>
<td>Capacity cost, R&amp;D</td>
<td></td>
</tr>
<tr>
<td>Capacity cost, manufacturing</td>
<td></td>
</tr>
<tr>
<td>Capacity cost, service</td>
<td></td>
</tr>
<tr>
<td>Bad Debt</td>
<td>Profit losses</td>
</tr>
<tr>
<td>Other income/cost external</td>
<td>Cost for external workforce, such as consultants</td>
</tr>
<tr>
<td>Operational currency gains/losses</td>
<td>Costs for fluctuations in currency</td>
</tr>
<tr>
<td>Other income/cost group</td>
<td>Closure / sales of factories, companies etc.</td>
</tr>
<tr>
<td>Depreciation according to plan on fixed assets</td>
<td>E.g. of buildings and machines</td>
</tr>
</tbody>
</table>

**Table 11 Definitions of Costs Included in Full Cost Model**
It is important to know how Cardo is allocating the costs to the products. Within the unit cost as well as within
the full cost model, the costs (both overhead and manufacturing costs) are allocated with respect to the total
amount of production hours spend on the total amount of products. Notable is that Cardo does not make any
difference between the different products, i.e. there are no connection between the products utilization of the
manufacturing machinery and the product cost. Later in the full cost implementation, the costs will be
allocated with respect to the utilization of the different resources, i.e. as activity based costing.

7.4.2 COMPONENTS IN QUOTES
To investigate what quotes usually consist of, an interview with the purchasing manager at Cardo was
performed. Most of the times, the quotes consist of: price per unit, costs for tools, startup costs, delivery
terms, payment terms, and the delivery lead-time, see the bullet list below.

- Price / unit
- Costs for tools
- Startup costs
- Delivery terms
- Payment terms
- Delivery lead-time

7.5 RELATIONSHIP
The relationship with the supplier involves different risks, which all sites agree upon. These risks are covered
within the supplier audit, which have been explained in section 7.3 and therefore not further explained in this
section. One interesting finding that sites A, B, C & D mentioned is the importance to have a beneficial contract
between the supplier and Cardo. The contract is supposed to formalize everything that is important for the
case. All sites state that it is also vital to have a procedure to follow up the supplier, regarding quality and
delivery performance. The reason for this is that once Cardo is connected with a supplier it is related to a cost
and commitment from both sides. The supplier has to deliver with a high quality and a good delivery
performance, this has to be monitored and followed up by Cardo. Employees in Site C argue that it is important
to find out the root cause of issues. Therefore, they demand that their supplier sends action plans for
correction of the root issues.

One finding from the interviews is that Cardo does not have a companywide method of working with supplier
relationship. Instead, relationships are managed by experience and knowledge, and the connection between
the strategic importance of the product and the suitable relationship for this is not applied at Cardo. Still, it is
important to know that Cardo is adjusting their supplier relationship in accordance to the strategic importance
of the product, but this is made via knowledge and experience and not in a structured way.
8 COMPARISON OF THEORY AND EMPIRICAL STUDY

The analysis of the empirical data and the theory is described in this chapter. The chapter has the structure of the four aspects identified in the thesis and presented in model version 1: core capability, risk, cost, and relationship.

8.1 CORE CAPABILITY

The core capability is an aspect that Cardo includes in make-or-buy analysis. However, there is no structured procedure for the identification of core capabilities, meaning that the core capability can be outsourced when the intention is not to. The empirical study revealed that the terms core capability, core competence and core activities did not have a companywide definition. Neither did the terms have the same meaning for all respondents. Most of the respondents defined the site’s core competence as a specific process/activity they performed well. The issue is that they do not know if it is a core competence or not. Another aspect that also is neglected is the connection between core competence and the business strategy that several researchers highlight (Brown & Wilson, 2005; McIvor R., 2000; Bakker, Wynford, & Nichols, 1994). If the core competence is outsourced, the company can lose their competitiveness in the market (McIvor R., 2000). This implies that the factories procedure for identifying core capability in make-or-buy decisions might threaten Cardo’s competitiveness in the market.

There are activities within Cardo preventing that strategically important components/products are outsourced without further investigation. The present outsourcing procedure is controlled at a division level; there are restrictions on what kind of make-or-buy decisions that can be made locally (on a factory-level). It is not allowed to take a make-or-buy decision of products and more strategically important outsourcing decisions locally; it has to be supported on a division level. Outsourcing decisions for components are performed locally with support from division level, if needed. This prevents strategically important decisions from being taken locally and thus the risk of losing competitiveness is lower. Instead, the management for each division must handle the knowledge on what core is. The connection between core activities and core close activities is an issue not covered in this procedure. It also demands that the management know the core capabilities of the company.

On division level, the company is more aware of the terms core competence, core activity and core capability. This minimizes the risk of outsourcing products/components that are in line with the strategically important aspects. However, there is a lack of directions from corporate level concerning what Cardo’s core capabilities, core competences and core activities are. The identification of the company’s core is affected by personal perceptions shaped by experience, company culture, trends and knowledge about the company and its market. In the present situation, it is a challenge to make sure that the business strategy and the core competence are still connected.

To overcome these challenges, two suggestions are proposed. Firstly, to connect the business strategy with the core competence of Cardo, a structured method is presented in the make-or-buy model on a corporate level. The empirical study revealed that persons in charge of strategy wanted to consider core competence in outsourcing analysis. They also argued that the core competence must derive from the business strategy, which is in line with the theory. From theory, the competence pyramid, value chain analysis, SWOT or focused SWOT analysis are possible methods for identifying core competence. Essential factors when deciding on a method to use are; the method must be straightforward, easy to use, not demand too much resources, and identify the core competences of Cardo. The value chain analysis is excluded as it is too resource demanding. The competence pyramid provides three interesting points of view, but does not present a structured procedure that can give guidance for Cardo. The focused SWOT analysis is easy to use, and is not to resource demanding. It also provides a structured and user-friendly way of investigating which strengths that are related to the core competences. It also makes the discussion about core competence more specific and makes it easier to discuss
the topic, a criteria one of the respondents argued for. The weakness of the SWOT analysis is that it fails to provide a structured way of identifying the core capability of the company. However, it has four interesting perspectives on the identification procedure for company strengths; market, financial, manufacturing, and organization. These points of view are missing in the focused SWOT analysis, so in order to develop a better model, the SWOT analysis’ four perspectives are combined with the focused SWOT structure (the model is still called the focused SWOT). The top management should use the focused SWOT analysis to identify the core capabilities, i.e. the core competences and the core activities of the company, because they have insight in Cardo’s strategy and can relate them to the company strategy.

The next step is to secure that the whole organization knows the core capabilities identified in the focused SWOT. There are already strategic documents (statement of directions) in each division that can be used for this purpose, by including a list of core competences and core activities. From the list, a decision maker is able to conclude if the component/product is connected to the core competence or core activity. This procedure is also in line with what a few respondents argued for in the interviews. They wanted to get information regarding what is core from higher levels of management. Today, Crawford’s statement of directions is more developed than ABS statement of direction. Crawford’s statement of direction includes methods for eliminating threats and act on the opportunities. Unfortunately, the core capability aspect has not been discussed explicitly when the statement of directions was developed. To communicate Cardo’s core capabilities, it is beneficial to use the statement of direction, since it is already widely used at Cardo.

The empirical study also revealed that there is a lack of communication between the corporate level and factory level, regarding the core capability. Instead of communicating what the core capabilities are, the headquarters choose to invest in core activities and not in activities they want to outsource. As a result, the factories investigate the non-invested activities where outsourcing can be an alternative to increase profits. In that way, the factories focus on their core activities even though not explicitly stated. This procedure, in combination with information on what core is, should clarify the make-or-buy decisions on a factory level.

8.2 Risk

As mentioned in chapter 7, Cardo has identified different risks associated with outsourcing. The three most commonly mentioned are financial, quality and delivery risks. Furthermore, the risks of losing knowledge and the power dependency situation towards the supplier are also discussed. These risks are dealt with through the supplier audits, quality controls of incoming goods in addition to regular controls of the suppliers regarding e.g. delivery performance, quality and lead-time. The Dun & Bradstreet financial report covers most of the financial risks involved in outsourcing decisions, including the risk of the supplier going bankrupt, the risk of poor payment ability from the supplier, and the overall financial status of the supplier. The supplier performance risk is the focus of the supplier audit and Dun & Bradstreet and therefore covered in present risk analysis. In this section, risks identified during the empirical study are added to list of theoretical risks.

The supplier audit is a well-known tool at Cardo, used at all visited sites, dealing with a number of the risks from the theory chapter. The make-or-buy analysis will be performed either on a supplier that already is evaluated or about to be evaluated, according to the company rules. In Table 12, a summary of the different risks is presented, in addition to how the supplier audit tool deals with them. If the risk is not considered in the supplier audit tool, the risk is mentioned in the table anyway. The numbers in the right column of Table 12 are referring to which category and sub-category in the supplier audit tool that are dealing with the risks. These categories and sub-categories are further explained in chapter 7.
The following risks are included in the supplier audit: technical, supplier dependence, communication, financial, quality, supplier performance and delivery. As one can see, not all risks described in the theory section are included in the supplier audit. As an example, there are also risks identified in the core capability section of the analysis; loss of critical skills and developing the wrong skills. The risks not included in the supplier audit must therefore be dealt with separately. As mentioned in chapter 3, Leender et al. (2006) described a method called weighted point evaluation (WPE) systems as a decision support tool, which is suitable for risk analysis. Oskarsson (2009) presents such a tool as weighted point method (WPM). The purpose of the risk analysis in this thesis is to highlight the existing risks related to outsourcing and work with them in a structured procedure. The question to be answered is if the risks in outsourcing are reasonable to take. To answer the question, a comparison between the risks to outsource and risks to keep the production in-house must be performed. The issue is that the internal and external risk is not the same and cannot be compared in a WPE or WPM. Instead, the same structure of a WPM is applied, but with two different lists (product dependent & supplier dependent) graded in a sliding scale between high and low instead of points is utilized in this thesis, referred as risk analysis tool (RAT). The risk tool is created to take the risks not included in the supplier audit into account. The risks that is incorporated in this model are; contractual risk, imitation and loss of competitive strength, commercial risk, loss of innovation risk, risk of double costs from doing to buying, loss of cross functional skills, the loss of ability to take activity back in-house, hidden costs, loss of organizational trust, loosing other knowledge, and investment. From this, three different categories are made: the risks that are covered by the supplier audit tool, the risks that are covered by the core capability identification and lastly the risk that needs to be covered in the risk analysis tool. This is summarized in Table 13 below. Cardo minimizes several risks in present procedures, but these risks do not disappear and therefore included in the RAT model.
TABLE 13 THE DIFFERENT RISKS

<table>
<thead>
<tr>
<th>Risk</th>
<th>Supplier audit category / sub-category / Other model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Technical risk</strong></td>
<td>4.0 + 5.6 + 6.3 + 1.3 + 3.0</td>
</tr>
<tr>
<td><strong>Risk related to relationship</strong></td>
<td></td>
</tr>
<tr>
<td>Contractual risk</td>
<td>RAT</td>
</tr>
<tr>
<td>Supplier Performance risk</td>
<td>Supplier Audit and Dun &amp; Bradstreet report</td>
</tr>
<tr>
<td>Supplier dependence or loss of control</td>
<td>2.6 + Dun &amp; Bradstreet report</td>
</tr>
<tr>
<td>Imitation and worsen competitive strength</td>
<td>RAT</td>
</tr>
<tr>
<td>Communication</td>
<td>2.3 + 7.4</td>
</tr>
<tr>
<td><strong>Commercial risk</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Loss of core competence</strong></td>
<td></td>
</tr>
<tr>
<td>Loss of critical skills</td>
<td>Core capability</td>
</tr>
<tr>
<td>Developing the wrong skills</td>
<td>Core capability</td>
</tr>
<tr>
<td>Loss of innovation</td>
<td>RAT</td>
</tr>
<tr>
<td><strong>Loss of ability to change</strong></td>
<td></td>
</tr>
<tr>
<td>Double costs</td>
<td>RAT</td>
</tr>
<tr>
<td>From doing to buying</td>
<td>RAT</td>
</tr>
<tr>
<td><strong>Loss of knowledge</strong></td>
<td></td>
</tr>
<tr>
<td>Loss of cross functional skills</td>
<td>RAT</td>
</tr>
<tr>
<td>Be able to take activity back in-house</td>
<td>RAT</td>
</tr>
<tr>
<td>Loosing other knowledge</td>
<td>RAT</td>
</tr>
<tr>
<td><strong>Hidden costs</strong></td>
<td></td>
</tr>
<tr>
<td>Financial</td>
<td>2.0 + Dun &amp; Bradstreet</td>
</tr>
<tr>
<td>Quality</td>
<td>1.0 + 5.0</td>
</tr>
<tr>
<td>Delivery</td>
<td>2.2 + 5.8 + 7.0</td>
</tr>
<tr>
<td>Power dependency</td>
<td>2.6 + Dun &amp; Bradstreet report</td>
</tr>
<tr>
<td>Investment</td>
<td>RAT</td>
</tr>
</tbody>
</table>

8.3 COST

To clarify the costs that Cardo considers today and what costs that should be included in make-or-buy analysis, a comparison between the theoretical total cost model and the unit cost, the full cost model and the quotes are performed below. The comparison is summarized in Table 14.

8.3.1 MAKE-ALTERNATIVE COST

Today, Cardo uses the unit cost in make-or-buy decisions, which includes direct labor and direct material costs that is the same as the manufacturing costs mentioned in the total cost model. To compensate for other possible costs, such as transportation costs and reception costs of incoming goods, a factor is used in the unit cost. This factor cannot be directly translated to the total cost model; instead, it partly considers the categories transportation costs, facilities cost and overhead cost. The other categories are not considered in the unit cost; therefore the cost calculations of today are not sufficient for make-or-buy analysis. The utilized factor is not based on anything statistically secure; rather it is based on feelings and therefore not a proper procedure of allocating these costs.

As mentioned earlier, Cardo is implementing a full cost model within the whole organization to be able to cover the full costs in the company. This model includes direct material, direct labor and quality costs in the production. The manufacturing cost includes the same costs in the total cost model. Noticeable is that the incoming transportation costs to the factory can be included in the price in the full cost model (in the total cost model a specific category handle transportation costs). If the incoming transportation cost is not included in the price, it must be added separately. The outgoing transportation cost is not covered in the full cost model and must therefore always be handled separately. The direct logistic costs in the full cost model covers the costs connected to the receiving of goods and the sending of goods. This means that the transportation cost is
partly covered in the full cost model. Moreover, variable manufacturing cost in combination with manufacturing capacity cost and depreciation according to plan on fixed assets covers the facilities cost described in the total cost model. Other overhead costs are covered by the capacity costs presented in the full cost model. The holding cost and WIP costs in the carrying costs category are not included in the full cost model’s first step of implementation. Until the holding and WIP costs are included in the full cost model, it must be handled separately in a make-or-buy analysis. Other costs are fluctuations in currency, variances from standard, inventory adjustments, and price differences in inventory, which can be included in other costs category. Direct installation costs and service costs, variable sales costs, bad debt, other income/cost external never affect the make-or-buy decision because they do not change if the choice is to make or if it is to buy.

The full cost model is a start of a total cost perspective in make-or-buy decisions and should be applied in model version 2, but must be complemented with the transportation costs, the complete carrying costs and the other costs categories, until it is fully developed. Noticeable is that it is planned an implementation of the complete carrying cost in phase two or three of the implementation procedure of the full cost model.

### 8.3.2 Buy-alternative cost

Usually a quote includes price per unit, cost of tools, startup costs, delivery terms, and delivery lead-time. The delivery terms (incoterms) and delivery lead-time is closely connected; the delivery terms determine where the ownership of the products changes. When there is a change of ownership, costs will occur for the buyer instead of the supplier, which must be considered in the cost model. The price can be compared to the internal manufacturing cost and facility costs. In cases where the transportation cost is included, this has to be added to the transportation costs category. The cost of tools can also be included in the manufacturing cost. The company needs to either to remove the carrying cost from the MA cost or add it to the BA cost. The overhead costs that occur when the products from the external source arrive at the factory must be added for the comparison of MA and BA costs. Additional costs that occur in a buy alternative are illustrated in the quotes column in Table 14. The definition of the total cost model is described in section 3.2.3.2.

<table>
<thead>
<tr>
<th>Total cost model</th>
<th>Unit costs</th>
<th>Full cost model</th>
<th>Quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carrying cost</td>
<td></td>
<td>Partly Considered</td>
<td>Not considered</td>
</tr>
<tr>
<td>Manufacturing costs</td>
<td>Considered</td>
<td>Considered</td>
<td>Included in price</td>
</tr>
<tr>
<td>Facilities costs</td>
<td>Partly considered</td>
<td>Considered</td>
<td>Included in price</td>
</tr>
<tr>
<td>Transportation costs</td>
<td>Partly considered</td>
<td>Partly considered</td>
<td>Partly included in price</td>
</tr>
<tr>
<td>Overhead costs</td>
<td></td>
<td>Considered</td>
<td>Not included</td>
</tr>
<tr>
<td>Other costs</td>
<td></td>
<td>Partly considered</td>
<td>Partly considered</td>
</tr>
</tbody>
</table>

**Table 14 Cost Comparison**

To compare the make and buy alternatives, the cost must be calculated from the same starting- and ending point in the supply chain. The costs have to be comparable, meaning that both the MA cost and the BA cost have to include the same costs. They are not comparable e.g. if the BA cost only is based on the supplier’s manufacturing price and excludes the transportation costs, packing costs, receiving costs, and quality control costs that can occur internally if the product is bought from an external source. I.e. it will be additional internal costs that must be added to the quotes to be able to compare the MA total cost and the BA total cost.

### 8.3.3 Cost Allocation

To be able to compare an MA cost with a BA cost it is vital that the correct cost for the internal costs is used. Therefore, the cost allocation procedure is essential. Today, the allocation procedure varies across the whole organization, i.e. there is no standardized procedure. As it is today, the allocation procedure is similar to the division method presented in chapter 3; the total cost for a period is divided with production volume to provide cost per product. This can make products more expensive than they really are, other products can have a lower cost than they should, and a last segment of products can be close to correct costs. This procedure is risky, e.g. a product that is manufactured in-house compared with an external source can be shown as having lower costs
when it actually is more expensive. This can lead to the product having a lower price in the market than the competitor’s products have. The financial department at Cardo is aware of this, and has started an allocation procedure that has an ABC allocation model as a goal, but it will take time before it is implemented. The ABC must be implemented to be able to take the right make-or-buy decision.

8.3.4 IDENTIFICATION PROCEDURE
To be able to identify the total cost in make-or-buy analysis, the total cost model presented in chapter 3 is used as a checklist of categories for the cost analysis. Oskarsson et al. (2006) and Trent et al. (2005) have developed a step method to cover the total costs, the first two steps in their model is the total cost model presented in this thesis. The persons performing the make-or-buy analysis must perform the steps left from the methods, because these steps must be adapted for each case.

8.4 RELATIONSHIP
In the present situation, Cardo has no companywide procedure for choosing the appropriate supplier relationship. This is not in accordance to Gelderman & van Weele (2002) that has proven the importance for a company to choose a proper relationship. Brandes (1994) and Brown & Wilson (2005) also support the significance of applying the correct supplier relationship. Today, Cardo is managing relationships by experience and knowledge. However, in more strategic and important decisions it is difficult to determine the proper supplier relationship. Therefore, the suggestion for Cardo is to use Kraljic’s matrix. Kraljic’s matrix is already used at few sites and the matrix is a well-known purchasing theory, which is rather intuitive and easy to use. According to Sanders et al (2007), there are four different types of relationships. These are nonstrategic transactions, contractual relationships, partnership, and alliances, see Table 15.

<table>
<thead>
<tr>
<th>Relationship</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonstrategic</td>
<td>Standardized products and relationships are transaction-orientated with low</td>
</tr>
<tr>
<td>transactions</td>
<td>critical activities. This means that there are no needs for deeper relations.</td>
</tr>
<tr>
<td>Contractual</td>
<td>Greater control over business and supplier is needed than in the Nonstrategic</td>
</tr>
<tr>
<td>relationships</td>
<td>Transactions. The critical level is still low and there is a dependency situation</td>
</tr>
<tr>
<td></td>
<td>between the parties.</td>
</tr>
<tr>
<td>Partnership</td>
<td>Critical activities where there are rather few suppliers. The activities have a high</td>
</tr>
<tr>
<td></td>
<td>critically. Strong trust between buyer and supplier, strong commitment to the</td>
</tr>
<tr>
<td></td>
<td>relationship.</td>
</tr>
<tr>
<td>Alliances</td>
<td>Outsourcing of critical activities were the products are of high strategic</td>
</tr>
<tr>
<td></td>
<td>importance. A need for deeper relation exists and the relationship is often very</td>
</tr>
<tr>
<td></td>
<td>strong. Few existing suppliers.</td>
</tr>
</tbody>
</table>

TABLE 15 RELATIONSHIPS DEFINITIONS

Each quadrant in Kraljic’s matrix implies different relationships. Therefore, each quadrant is combined with a relationship form Table 15, which is described below.

Non-critical quadrant
In the non-critical quadrant, Cardo should use the open market to push the price down and should not have any strategic relationships with their suppliers. This is because the products are easily available from many suppliers and involves low financial risk, which is typical for standard products. The buyer can have agreements for longer periods with suppliers, to ensure the supply of products and to minimize their own workload. A suitable relationship in this quadrant is nonstrategic transactions.

Leverage quadrant
In the leverage quadrant, Cardo has to exploit their purchasing power, because there are many potential suppliers and a high purchasing value in each buy. It is recommended to purchase components, and exploit the competition in the market to negotiate a lower price. Leverage items are low in supply risk but associated with high financial impact for the buying company. It is not suitable to have a long-term relationship with the supplier. In the leverage quadrant is contractual relationship a preferable relationship.
Bottleneck quadrant
In the bottleneck quadrant, it is important for the buyer to secure supply, as there are a limited number of suppliers of the product. Therefore, it is recommended to establish long-term relations with the suppliers delivering bottleneck products to secure the supply. A partnership would be a good relationship in this quadrant.

Strategic quadrant
The last quadrant is the strategic one; where the products are of high financial and supply risk, i.e. there are few suppliers able to deliver and the purchase is associated with high financial risk for the buyer. In this category, it is important to secure supply and this can be done via strategic relationships with the supplier. A suitable relationship in this quadrant would be alliance.
9 MODEL VERSION 2

This chapter describes model version 2 in a user-friendly manner, meaning that there is repetitions from previous chapters and there are no references stated. For the interested reader, all references that have been used from theory can be found in chapter 3. Model version 2 commences with an overview of the model followed by a description of each aspect dealt with in the model. Notice, model version 2 is a draft version of the final model.

9.1 OVERVIEW OF THE MODEL

Model version 2 consists of four steps that function as a guide for a make-or-buy decision at Cardo. To provide an overview of how the model is used, the connections between the categories are described in combination with the tools that are used for identification of each aspect. This is described in step 0-4 and illustrated in Figure 24. The next section includes detailed descriptions of how each step should be performed.

Step 0 – Identification of Cardo’s core capability
Model version 2 starts with the identification of core competences and core activities of Cardo. Top management that has insight in the business strategy must perform this. When core capabilities are developed, they must be correlated to the business strategy. Otherwise, there is a risk that Cardo focuses on competences and activities that are not essential for the business strategy. The identification of core capabilities is performed through the focused SWOT analysis, described in the core capability section of this chapter. The focused SWOT analysis generates a list of core competences and core activities, which is used in step 1 of the model. The list of core competences and core activities must be continuously updated as the core capabilities change over time. To transfer the list into the whole organization, the statement of directions for each division should include a list of Cardo’s core capabilities. Important to notice is that each division has different core capabilities.

Step 1 – Core capability
The product/component that is considered in the make-or-buy analysis must be coordinated with the list from the focused SWOT analysis in step 0. The product/component must be evaluated to identify whether it is connected to the core capability of the company, but also if the product is closely connected to the core capability. Even core close activities can affect the competitiveness of Cardo. If the outsourced product/component affects Cardo’s core capability negatively, make the product in-house. If it not affects the core capability, proceed to step 2.

Step 2 – Major risks
First, investigate if there are potential suppliers for the buy alternative. To evaluate potential suppliers in the market, the supplier audit tool is used. If there are no suitable suppliers, manufacture the product/component in-house. If there are suitable suppliers, evaluate the risks associated with the product/component in a RAT. If the risks related to outsourcing is too high, manufacture in-house. If the risks are manageable, proceed to step 3.

Step 3 – Lowest costs
Evaluate the costs associated with the make-or-buy decision with a total cost perspective. If it involves lower costs to manufacture in-house, investigate whether there other reasons to outsource than lower costs that are worth paying a higher manufacturing price for. If there are lower costs related to outsourcing, it must be evaluated if the cost difference is enough. If it is a doubtful case, the risk analysis can be performed again, to evaluate if the risks are worth the cost reduction.

Step 4 – Relationship analysis
Kraljic’s matrix is used to give guidelines for selection of a suitable relationship with a supplier for the product/component that is chosen to outsource.
The core capability aspect is essential for a make-or-buy decision. If Cardo’s core capabilities are undermined through outsourcing, the competitiveness in the market is lost. To be able to identify the core capability of Cardo, it is essential to know the difference between core competence, core activity, and core capability. Otherwise, it is hard to discover the correlation between the aspects and how this affects the competitiveness. The definition of the three terms and the correlation between them is presented in Appendix D. The identification procedure is structured according to the focused SWOT analysis presented in Figure 25.

### Step 1 - Core Capability

The event-factor review’s (EFR) purpose is to identify Cardo’s core strengths in a list that is:

- **Concise**, only the core strengths should be included in the list.
- **Actionable**, the strength must be controlled off by Cardo. It must be possible to translate strengths into actions.
• **Significant**, the strength must have significant impact on Cardo’s value.
• **Authentic**, the list must be real, not wishful thinking.

These four points must be kept in mind when the list is developed. The analysis of strengths is performed through events. Event is a previous important success within Cardo, such as winning a first-tier customer contract. The EFR should at least consist of six to nine events. The strengths from each event are identified through four perspectives:

• Marketing perspective
• Finance perspective
• Manufacturing perspective
• Organization perspective

The identified strengths must be vital for the success of the event; it is not certain that each perspective has such strength. An illustration of an event-factor review is shown in Table 16. The EFR procedure generates a list of strengths, which is the last action performed in step 1.

<table>
<thead>
<tr>
<th>Events</th>
<th>Perspective</th>
<th>Strengths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event 1</td>
<td>Marketing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Finance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Manufacturing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Organization</td>
<td></td>
</tr>
<tr>
<td>Event 2</td>
<td>Marketing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Finance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Manufacturing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Organization</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 16 EFR**

**Step 1.2 – Reduce list**
In step 2, the list of strengths from step 1 must be reduced from:

• **Redundancy**, strengths that are repeated.
• **Vagueness**, strengths that are indistinct.
• **Irrelevant symptoms**, strengths that are irrelevant.

The reduced list of strengths is used in step 1.3 to identify the core competences and core activities.

**Step 1.3 – The CCT**
Develop a core competence tree (CCT) through the leading strength of Cardo, e.g. creation of owner value. The strengths from the list are linked through cause-effect arrows; to each other and the leading strength. If needed, one can add strengths not identified in step 2 to fill any gaps. At the roots of the CCT, the strengths that cannot be explained by other strengths are located. These strengths are Cardo’s core competences. An illustration of a CCT is illustrated in Figure 26. The core competences are linked to a few activities in the CCT and these activities are the core activities of Cardo. Together, the core competences and the core activities make up the core capability of Cardo.
An outsourcing decision is connected to both internal and external risks. It is vital to be aware of all major risks associated to outsourcing, and have a structured method to work with them. Otherwise, it is possible that the cost to outsource becomes higher than expected and knowledge can be lost etc. Therefore, the most common risks in outsourcing and the procedure to relate the risks to outsourcing are described in this section. The most common risks are defined in appendix D, to create an understanding of the risks.

To consider the identified risks three tools are identified: Supplier audit (SA), risk analysis tool (RAT) and the identification of core capabilities. The supplier audit tool is a well know tool at Cardo, used on all existing and new suppliers. The RAT-model is a structured way of quantifying risks and is presented in more detail below. The identification of core capabilities are presented in step 1, and considers a few of the risks defined in Appendix D. The identified risks and selected tool for handling the risks in outsourcing are presented in Table 17 below. The numbers in the right column of Table 17 are referring to which category and sub-category in the supplier audit tool that are dealing with the risks.

<table>
<thead>
<tr>
<th>Risk</th>
<th>Supplier audit category / sub-category / Other model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical</td>
<td>SA(4.0 + 5.6 + 6.3 + 1.3 + 3.0)</td>
</tr>
<tr>
<td>Risk related to relationship</td>
<td></td>
</tr>
<tr>
<td>Contractual</td>
<td>RAT</td>
</tr>
<tr>
<td>Supplier Performance</td>
<td>RAT</td>
</tr>
<tr>
<td>Supplier dependence or loss of control</td>
<td>SA(2.6) + Dun &amp; Bradstreet report</td>
</tr>
<tr>
<td>Imitation and worsen competitive strength</td>
<td>RAT</td>
</tr>
<tr>
<td>Communication</td>
<td>SA(2.3 + 7.4)</td>
</tr>
<tr>
<td>Commercial</td>
<td>RAT</td>
</tr>
<tr>
<td>Loss of core competence</td>
<td></td>
</tr>
<tr>
<td>Loss of critical skills</td>
<td>Core capability</td>
</tr>
<tr>
<td>Developing the wrong skills</td>
<td>Core capability</td>
</tr>
<tr>
<td>Loss of innovation</td>
<td>RAT</td>
</tr>
<tr>
<td>Lack of ability to change</td>
<td></td>
</tr>
<tr>
<td>Double costs</td>
<td>RAT</td>
</tr>
<tr>
<td>From doing to buying</td>
<td>RAT</td>
</tr>
<tr>
<td>Loss of knowledge</td>
<td></td>
</tr>
<tr>
<td>Loss of cross functional skills</td>
<td>RAT</td>
</tr>
<tr>
<td>Be able to take activity back in-house</td>
<td>RAT</td>
</tr>
<tr>
<td>Hidden costs</td>
<td>RAT</td>
</tr>
<tr>
<td>Loss of organizational trust</td>
<td>RAT</td>
</tr>
<tr>
<td>Financial</td>
<td>SA(2.0) + Dun &amp; Bradstreet</td>
</tr>
<tr>
<td>Quality</td>
<td>SA(1.0 + 5.0)</td>
</tr>
</tbody>
</table>
The structure of step 2 – risks is: first, use the supplier audit tool to identify possible suppliers and identify the risks connected to suppliers. Second, use RAT to analyze the risks not covered in the supplier audit tool. The structure is illustrated in Figure 27.

**FIGURE 27 STRUCTURE OF STEP 2**

**Step 2.1 – Supplier Audit**
Investigate, with the supplier audit tool, if potential suppliers exist for outsourcing of the investigated item. When using the supplier audit tool, the supplier is approved and therefore those risks are controlled. If the supplier has a very low score on few vital aspects, an action plan has to be applied to correct these faults. It is important to control if the supplier is “good or bad” on the aspects that affect the make-or-buy decision. If the supplier is approved, it is also approved for outsourcing. Therefore, the supplier audit is a knockout criteria; if the supplier audit does not approve a supplier the supplier is not considered as a suitable supplier for outsourcing.

**Step 2.2 – Risk analysis tool**
The principles of RAT are that the risks are defined and placed in Table 18 (external risks) and Table 19 (Internal risks). The reason that internal and external risks are divided in the RAT model is that it should be possible to compare these perspectives. Each risk is given a weight, e.g. low/high towards the importance for the decision. After this, the possibility of the risk to occur is investigated and graded in low or high possibility. It must also be motivated why the risk is important (or not) for the decision and why it is a high or low possibility that the risk occurs. There are four possible outcomes for each risk, see below.

- High/High, The risk is vital, reduce risk
- High/Low, ok to proceed to step 3
- Low/High, reduce risk
- Low/Low, ok to proceed to step 3

<table>
<thead>
<tr>
<th>External Risks</th>
<th>Importance for decision (Low/High)</th>
<th>Risk (Low/High)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contractual</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Imitation and worsen competitive strength</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commercial</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loss of innovation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Double costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>From doing to buying</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loss of cross functional skills</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Be able to take activity back in-house</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loosing other knowledge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hidden costs</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Loss of organizational trust

<table>
<thead>
<tr>
<th>TABLE 18 EXTERNAL RAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal Risks</td>
</tr>
<tr>
<td>Investment</td>
</tr>
<tr>
<td>Double costs</td>
</tr>
<tr>
<td>Worsen competitive strength</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TABLE 19 INTERNAL RAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.4 STEP 3 - COSTS</td>
</tr>
</tbody>
</table>

Cost is by far the most mentioned aspect when considering outsourcing. The importance of considering the total cost of the decision is of course highly important. There are two costs to compare; the cost of making in-house (the make alternative) and the cost of buying (the buy alternative). The structure of step 3 - costs is: first, calculate make alternative (MA) cost. Second, calculate the buy alternative (BA) external costs. Third, compare the MA and BA cost. This is illustrated in Figure 28. These three steps must use the total cost model as a framework to make sure that the total cost is covered in the analysis. The total cost model is described below.

**FIGURE 28 STRUCTURE OF STEP 3**

The total cost model consists of six categories and functions as a framework for make-or-buy decisions, all categories must be covered but it is not for sure that all elements in each category are included. Only costs with significant impact on the decision should be included. The model is illustrated in Figure 29.

**FIGURE 29 TOTAL COST**

**Carrying cost**
The carrying cost includes the holding cost, work in progress (WIP), obsolescence and waste costs.

**Manufacturing costs**
Within this category direct labor costs, direct material price and quality costs are included. The direct material price consists only of the purchasing price. It is important to keep in mind that this cost can be divided into other cost categories depending on what is included in a quote, e.g., transportation costs. Direct labor consists of the wages for the machine-operators. The quality costs consist of all the extra quality costs that occur within the production facilities and not when the product has left the building, e.g., at a warehouse or installed at the customer's facilities.
Facilities costs
Facilities are defined as the warehouses, factories and other facilities. The facilities costs includes staff wages related to the facilities and costs directly linked to the facilities, such as insurance costs. The staff included in this category is support-function, such as forklift-operators, cleaning personnel and janitors. It is important to know that the staff does not include the machine-operators and white-collar workers. Other costs within this category are; Costs for storage areas / buildings, equipment for handling goods and producing (e.g. cranes, forklifts, tools and production-machinery), costs for other storage equipment such as shelves and administrative inventory-handling system. The costs for transports within the facilities are also included in the facility costs. Cost of expediting, receiving, inspection and incoming quality control are also included here.

Transportation costs
All transportation costs (both internal and external) is included, the only transport not included within this area is the transportation inside the warehouses and factories. Costs associated with the transports are also included, e.g. freight taxes and custom duty.

Overhead costs
Overhead costs for departments such as R &D, purchasing, production, sales and financial departments. If products or components are outsourced, costs related to supplier relationship increase. Within this category, costs such as supplier audits, support costs, communication costs, and costs related to the relationship are included. All administration costs related to the product such as billing, reception of orders, salary payments and economical follow-ups is also included in the overhead costs.

Other costs
Other costs includes all other costs related to the make-or-buy decisions that do not fit in any other category, e.g. information systems, marketing currency costs, payment fees and end-of-life costs. It is important to take into consideration costs that do not fit in the categories, as they can affect the total costs significantly. To notify, if extra quality costs occur outside the production facilities they must be accounted for in this category.

Step 3.1 – MA cost calculation
The MA costs originate from the full cost model that Cardo is implementing. The full cost model covers many of the costs from the total cost model, but still a few of them need to be added to cover the full MA cost. In Table 20, the categories from the total cost model are compared with the costs included in the full cost model.

<table>
<thead>
<tr>
<th>Total cost model</th>
<th>Full cost model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carrying cost</td>
<td>Partly considered</td>
</tr>
<tr>
<td>Manufacturing costs</td>
<td>Considered</td>
</tr>
<tr>
<td>Facilities costs</td>
<td>Considered</td>
</tr>
<tr>
<td>Transportation costs</td>
<td>Partly considered</td>
</tr>
<tr>
<td>Overhead costs</td>
<td>Considered</td>
</tr>
<tr>
<td>Other costs</td>
<td>Partly considered</td>
</tr>
</tbody>
</table>

TABLE 20 COSTS THAT ARE CONSIDERED IN FULL COST MODEL

The partly considered elements and the not considered elements need to be addressed separately. First, the holding and WIP costs of the carrying cost is not covered in the full cost model and needs to be added. The complete carrying cost will be included in the full cost model in the future, but today, it is not included. The transportation costs are only partly covered, including only incoming transports if it is included in the price from the supplier. The internal transports with forklifts are covered in the full cost model but the other transports, internal between factories and external to the customer, is not included and therefore has to be added. The other costs category is special because it includes all costs not covered by any of the other categories but still significant enough to consider, therefore this category needs to be added. The costs that need to be added are shown in the bullet-list below:

- Carrying costs
Transportation costs
  - From the supplier (depending on delivery terms)
  - Internal between factories / facilities
  - To the customer

Other costs

Step 3.2 – BA cost calculation
The quotes are the base of the BA costs. The costs derived from the total cost model that are included / excluded from the quotes are shown in Table 21. The quote does not consider the complete carrying costs category, which have to be added separately. The incoming transportation costs are covered in the delivery terms, and if the delivery terms include the price of transportation, there is no need to add this cost separately. Other transportation costs need to be added to the cost model separately. The overhead costs are not included in the quote and needs to be added to the model e.g. costs for administration of quotes and transports. The “other cost” category needs to be dealt with on a situational basis and therefore has to be added separately. The costs that need to be added are showed in the bullet-list below:

- Complete carrying costs
- Transportation costs
  - From the supplier (depending on the delivery terms)
  - Internal between factories / facilities
  - To the customer
- Other costs
- Overhead costs

<table>
<thead>
<tr>
<th>Total cost model</th>
<th>Quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carrying costs</td>
<td>Partly considered</td>
</tr>
<tr>
<td>Manufacturing costs</td>
<td>Included in price</td>
</tr>
<tr>
<td>Facilities costs</td>
<td>Included in price</td>
</tr>
<tr>
<td>Transportation costs</td>
<td>Partly included in price</td>
</tr>
<tr>
<td>Overhead costs</td>
<td>Not included</td>
</tr>
<tr>
<td>Other costs</td>
<td>Partly considered</td>
</tr>
</tbody>
</table>

TABLE 21 COSTS THAT ARE CONSIDERED IN QUOTES

Step 3.3 – Comparison of MA and BA costs
To compare both alternatives, it is essential that the same costs are applied to each option. Therefore, the cost model has to be adapted to each situation and in some cases costs has to add to the BA cost and in some cases costs has to be added to the MA costs, depending on the situation. When the costs are calculated so they represent comparable costs, they have to be compared. The alternative with the lowest total cost is the one to prefer. If the total cost difference is small, it is important to consider the risks also. If the risk is much higher and the cost difference is rather small then it might be better to take a higher cost and minimize the risks. There can also be other factors that are important to consider besides just the cost difference, e.g. if Cardo wants access to new technology or knowledge. In these cases, it might be less important with a low price and therefore the buy alternative can be the best.

It is also very important to remember that if the option of buying instead of making is applied, the overhead costs have to be allocated to the other products. This leads to a higher cost on these products and it could then seem attractive to outsource these as well, a phenomenon referred to as the outsourcing trap. Another important activity is to allocate the costs in a proper way. Currently at Cardo, the costs allocation method is not sufficient for make-or-buy analysis. In the future, the costs will be allocated with activity based costing that assigns the correct costs to the products. Until this method is implemented at Cardo, they need to be aware that their way of allocating cost affects the price of the products, meaning that products can appear to be more expensive than they really are and vice versa.
9.5 Step 4 - Relationship

The type of relationship is closely connected to power-dependency in a relationship. If a company has only one supplier of a product that is vital to their production, one can say that the company is highly dependent on the supplier, and thus the supplier has relatively high power in the relationship. One way of analyzing what kind of relationship that is proper for a company to have with a particular supplier is to make use of Kraljic’s matrix. The procedure in step 4 – relations is: first, identify the supply and financial risk assessed for the make-or-buy item and match this with Kraljic’s matrix. Second, identify the suitable relationship for the make-or-buy item according to the descriptions in step 4.2. The structure is illustrated in figure below.

**Step 4.1**
According to Kraljic, the type of relationship is depending on the financial risk and the supply risk involved. Financial risk is defined as the strategic importance of the purchasing in terms of the volume purchased and impact on business growth or quality. Supply risk is defined as the number of suppliers available, substitution possibilities and competitive demand. Kraljic’s model considers the combination of financial risk and supply risk, which is divided into four different quadrants in a 2x2 matrix. Each quadrant gives guidance as for how the company should act when choosing their supplier relationship, see Figure 31. The financial and supply risk has to be assessed for the make-or-buy objective, for evaluation in Kraljic’s matrix. After this, the proper relationship can be chosen according to descriptions stated in step 4.2.

**Step 4.2**
The different types of relationships mentioned below are defined in appendix D.

**Non-critical quadrant**
In the non-critical quadrant, Cardo should use the open market to push the price down and should not have any strategic relationships with their suppliers. This is because the products are easily available from many suppliers and involves low financial risk, which is typical for standard products. The buyer can have agreements for longer periods with suppliers, to ensure the supply of products and to minimize their own workload. A suitable relationship in this quadrant is nonstrategic transactions.

**Leverage quadrant**
In the leverage quadrant, Cardo has to exploit their purchasing power, because there are many potential suppliers and a high purchasing value in each buy. It is recommended to purchase components, and exploit the competition in the market to negotiate a lower price. Leverage items are low in supply risk but associated with high financial impact for the buying company. It is not suitable to have a long-term relationship with the supplier. In the leverage quadrant is contractual relationship a preferable relationship.

**Bottleneck quadrant**

In the bottleneck quadrant, it is important for the buyer to secure supply, as there are a limited number of suppliers of the product. Therefore, it is recommended to establish long-term relations with the suppliers delivering bottleneck products to secure the supply. A partnership would be a good relationship in this quadrant.

**Strategic quadrant**

The last quadrant is the strategic one; where the products are of high financial and supply risk, i.e. there are few suppliers able to deliver and the purchase is associated with high financial risk for the buyer. In this category, it is important to secure supply and this can be done via strategic relationships with the supplier. A suitable relationship in this quadrant would be alliance.
Chapter 10

Model evaluation

Several end-users reviewed model version 2 and suggested improvements. The major improvements of the model are presented in this chapter. Alongside these major improvements, smaller adjustments were performed, but these are not presented in this chapter.

During the reviews practical issues was stated. One of the major issues concerned the supplier audits; they take at least one day to conduct for two persons. Therefore, it is very costly to perform on many suppliers. The suggestion was, to first conduct a study of the risks connected to the product and not related to the different suppliers. The risk is evaluated with the risk analysis tool. If these risks are too high, a lot of work is saved, because further investigation is not needed. If these risks are minor, the next step is to investigate if there is potential supplier on the market. Cardo’s present procedure is applied for the supplier selection; the procedure is not investigated in this thesis and therefore not described in the model. Instead, the supplier selection is added into the model figure to enhance the requirement of supplier selection before cost calculations can be performed, see Figure 32.

After step 3 - costs, supplier audits have to be conducted. This on at least the two most interesting suppliers, the supplier audit should not only be conducted on the alternative with the lowest total cost. It can be other important factors that must be considered for best alternative. This provides decried synergies to Cardo, because existing suppliers are recognized which can minimize the total amount of suppliers.

Improvements were also suggested for step 3 - costs. The manufacturing cost category included the direct material price in model version 2. The direct material price is a significant cost element for make-or-buy analysis. The MA cost is compared with the BA cost in form of a quote that includes the price. Because of these aspects, the total cost model is modified from six categories to seven categories, where direct material price is the new category. Moreover, both Table 20 and Table 21, where the total cost model is compared with the full cost model and the quotes, were unclear for several persons that reviewed the model. Therefore, the tables are combined directly with costs that not are included but must be included. In the tables, it is addressed what costs that are included in the full cost model and what costs that must be added separately. The discussants and the supervisor at the university addressed that step 3 – costs were difficult to understand, an example should make the step clearer. The reason for this was mainly that the comparison of costs was unclear. To solve the issue an example is included in model version 3.

The core capability aspect was confusing in model version 2. It was difficult to understand if step 0 should be performed in each analysis. Another drawback was that step 0 was described in step 1 in the model. Therefore, a new structure of the model was developed. Step 0 was changed to pre-requests, this to clarify that the focused SWOT analysis should be performed by top management and local teams and not performed in each analysis. In step 1, it is only described that the core capability list must be used to control if the product/component affects the core capability or not.

One respondent explained that there was a risk management method for handling catastrophe risks, e.g. fires or vital machinery failure. This is a part of the risk management program that site C are using, but the method was not explained during the empirical study. The method is rather generic and had the same fundamental structure as the RAT described in model version 2. One improvement that could be applied to the RAT is to use a sliding scale between high and low, and then use a 2x2 matrix to locate what to recommend in a specific scenario, which is applied in model version 3. Due to copyright protection, the risk management method cannot be presented in this thesis. However, since it has the same fundamental structure the RAT is chosen.
11 Model version 3

The changes described in chapter 10 are applied on model version 2. This creates model version 3, which is presented in this chapter. Model version 3 is the final version of the generic make-or-buy model.

11.1 Overview of the model

Model version 3 consists of four steps functioning as a guide for a make-or-buy decision at Cardo. To give an overview of how the model is used, the connections between the categories are described in combination with the tools that are used for identification of each aspect. This is described in step 1-4 and illustrated in Figure 32. The next section includes detailed descriptions of how each step should be performed.

Pre-request – Identification of Cardo’s core capabilities
Before the make-or-buy analysis can be performed, the top management that has insight in the business strategy in combination with local management teams must identify the division’s core capabilities. Notice, each division has different core capabilities, meaning that this must be performed on all divisions. When the core capabilities are identified, they must be correlated to the business strategy. Otherwise, there is a risk that Cardo focuses on competences and activities that are unessential for the business strategy. The identification of core capabilities is performed through the focused SWOT analysis, described in pre-request section of this chapter. The focused SWOT analysis generates a list of core competences and core activities, which is used in step 1 of the model. The list of core competences and core activities must be continuously updated as the core capabilities change over time, e.g. when the statement of direction is updated. To transfer the list into the whole organization, the statement of directions for each division should include a list of the division’s core capabilities.

Step 1 – Core capability
The product/component considered for outsourcing must be evaluated to reveal if it is connected to the core capabilities of Cardo, this through the list from the focused SWOT analysis. Even though the product/component is not directly linked to the core capabilities, it is important to remember that core close capabilities also affect the core capabilities. If the investigated product/component affects Cardo’s core capability negatively, make the product in-house. If it does not affect the core capability, proceed to step 2.

Step 2 – Major risks
First, investigate the risks connected to the product with the risk analysis tool. If these risks are manageable, use Cardo’s present procedures to identified suitable suppliers and proceed to step 3. If the risks are too high; it is important to reduce them. Otherwise, make the product/component in-house. Before the costs can be calculated, interesting suppliers must be chosen with the present procedures for supplier selection.

Step 3 – Lowest costs
Evaluate the costs associated with the make-or-buy decision with a total cost perspective. If it is a lower cost to manufacture in-house, investigate whether there are other reasons to outsource then to lower the costs that are worth a higher cost. If the cost is lower to outsource, the supplier must be evaluated in a supplier audit. The supplier audit must be complemented with two supplier dependent risks: contractual risk and the risk of imitation and worsen competitive strength. If the supplier is approved, the risks must be compared with the total cost, if the cost saving is “worth” the risks it is recommended to buy. If the risks are too high compared with the cost saving, the supplier is not optimal for the make-or-buy decision. If this is the case another supplier must be audited against the cost saving. If the risks are low compared with the cost savings it is recommended to buy and proceed to step 4.

Step 4 – Relationship analysis
Kralic’s matrix is used to give guidelines for the supplier selection for the chosen product/component to outsource. Depending on the financial risk and the supply risk of the product, a number of different relationships are suggested.

**FIGURE 32 MODEL VERSION 3**

### 11.2 PRE-REQUEST — IDENTIFICATION OF CORE CAPABILITIES

The top management of the division should perform the pre-request step with input from local management teams. The core capability aspect is essential for a make-or-buy decision. If Cardo’s core capabilities are undermined through outsourcing, the competitiveness in the market is lost. To be able to identify the core capability of Cardo, it is vital to know the difference between core competence, core activity, and core capability. Otherwise, it is hard to discover the correlation between the aspects and how this affects the competitiveness. The definition of the three terms and the correlation between them is presented in Appendix D. The identification procedure is structured according to the focused SWOT analysis presented in Figure 33.

**FIGURE 33 STRUCTURE OF STEP 1**

**Step 1 - Event-factor review**

The event-factor review’s (EFR) purpose is to identify Cardo’s core strengths in a list that is:
- **Concise**, only the core strengths should be included in the list; the list should be short.
- **Actionable**, the strength must be controlled by Cardo. It must be possible to translate strengths into actions. The strength must exist over time.
- **Significant**, the strength must have significant impact on Cardo’s value.
- **Authentic**, the list must be real, not wishful thinking.

These four aspects must be kept in mind when the list is developed. The analysis of strengths is performed through events. An event is a previous important success within Cardo, such as winning a first-tier customer contract. The EFR should at least consist of six to nine events. The strengths from each event are identified through four perspectives:

- Marketing perspective
- Finance perspective
- Manufacturing perspective
- Organization perspective

The identified strengths must be vital for the success of the event; it is not certain that each perspective has such strength. An illustration of an EFR is shown in Table 22. The EFR procedure generates a list of strengths.

<table>
<thead>
<tr>
<th>Events</th>
<th>Perspective</th>
<th>Strengths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event 1</td>
<td>Marketing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Finance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Manufacturing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Organization</td>
<td></td>
</tr>
<tr>
<td>Event 2</td>
<td>Marketing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Finance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Manufacturing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Organization</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 22 EFR**

**Step 2 – Reduce list**
In step 2, the list of strengths from step 1 must be reduced from:

- **Redundancy**, strengths that are repeated.
- **Vagueness**, strengths that is indistinct.
- **Irrelevant symptoms**, strengths that is irrelevant.

The reduced list of strengths is used in step 3 to identify the core competences and core activities.

**Step 3 – The CCT**
Develop a core competence tree (CCT) through the leading strength of Cardo, e.g. creation of owner value. The strengths from the list are linked through cause-effect arrows to each other and the leading strength. If needed, one can add strengths not identified in step 2 to fill any gaps. At the roots of the CCT, the strengths that cannot be explained by other strengths are located. These strengths are Cardo’s core competences. The core competences are linked to a few activities in the CCT and these activities are the core activities of Cardo, illustration Figure 34. Together, the core competences and the core activities make up the core capability of Cardo.
11.3 Step 1 – Core Capability

It must be controlled if the product/component affects the core capabilities of the division, if it is outsourced. Use the core capability list presented in the statement of directions. If the product/component undermines the core capability when outsourced, it should not be outsourced.

11.4 Step 2 – Risk

It is vital to be aware of all major risks associated to outsourcing, and have a structured method to work with them. Otherwise, it is possible that the cost to outsource becomes higher than expected, and knowledge can be lost etc. Therefore, the most common risks in outsourcing and the procedure to relate the risks to outsourcing are described in this section. The most common risks are defined in Appendix D.

The first risks to be considered are product dependent risks, which are defined in Table 23. To consider these risks, the risk analysis tool (RAT) is used. The principles of RAT are: the risks are defined and placed in Table 23. Each risk is given a weight on sliding scale from low to high, towards the importance for the decision. After this, the likelihood of the risk to occur is investigated, and graded in a sliding scale between low and high possibility. It must also be motivated why the risk is important (or not) for the decision and why it is a high or low possibility that the risk occurs.

<table>
<thead>
<tr>
<th>Risk</th>
<th>Importance for decision (Low/High)</th>
<th>Likelihood (Low/High)</th>
<th>Motivation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loss of innovation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Double costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>From doing to buying</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loss of cross functional skills</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Be able to take activity back in-house</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loosing other knowledge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hidden costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loss of organizational trust</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Double costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worsen competitive strength</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TABLE 23 RISK CONNECTED TO PRODUCT

This implies that there are four possible extremities: The first is high importance and high risk (high/high), which is considered to be a high risk category to outsource. The high/high combination needs to be managed
and reduced before considering outsourcing as an option. The next combination is high importance and low risk (high/low), because of the low risk; proceed to step 3. The third combination is low importance and high risk (low/high); this risk has to be reduced even though it is of low importance to decision, because the risk can affect the company in the future. The last combination is low importance and low risk (low/low), where it is suggested to proceed to step 3. This procedure is illustrated Figure 35.

![FIGURE 35 RISK PROCEDURE](image)

If the risk related to the product is manageable, interesting suppliers for the product/component must be selected with the present supplier selection procedure used in Cardo today. First investigate if any supplier exists in the market that can be candidates for the case. These suppliers are described in a gross list that must be reduced to a short list that only includes the most attractive suppliers.

### 11.5 Step 3 - Costs

Cost is by far the most mentioned aspect when considering outsourcing. Considering the total cost of the decision is off course highly important. There are two cost categories to compare; the cost of making in-house (the make alternative, MA) and the cost of buying (the buy alternative, BA). To compare the make and buy alternatives, the cost must be calculated from the same starting- and ending point in the supply chain. The costs have to be comparable, meaning that both the MA cost and the BA cost have to include the same costs. An example in Appendix D clarifies the total cost perspective. The structure of step 3 - costs is: first, calculate MA costs. Second, calculate the BA costs. Third, compare the internal and external cost. This is illustrated in Figure 36. In these three steps, the total cost model must be used as a framework to make sure that the total cost is covered in the analysis. The total cost model is described below.

![FIGURE 36 STRUCTURE OF STEP 3](image)

#### Total costs model

The total cost model consists of seven categories and functions as a framework for cost calculations in make-or-buy decisions, all categories must be covered, but it is not for sure that all elements in each category are
included. Only costs with significant impact on the decision should be included. The model is illustrated in Figure 37.

**FIGURE 37 TOTAL COST**

**Carrying cost**
The carrying cost includes the holding cost, work in progress (WIP), obsolescence and waste.

**Manufacturing costs**
Within this category, direct labor costs and quality costs are included. Direct labor consists of the wages for the machine-operators. The quality costs consist of all extra quality costs that occur within the production facilities and not when the product has left the building, e.g. at a warehouse or installed at the customer’s facilities.

**Facilities costs**
Facilities are defined as the warehouses, factories and other facilities. The facilities costs include staff wages related to the facilities and costs directly linked to the facilities, such as insurance costs. The staff included in this category is support-function, such as forklift-operators, cleaning personnel and janitors. It is important to know that the staff does not include the machine-operators and white-collar workers. Other costs within this category are; Costs for storage areas / buildings, equipment for handling goods and producing (e.g. cranes, forklifts, tools and production-machinery), costs for other storage equipment such as shelves and administrative inventory-handling system. The costs for transports within the facilities are also included in the facility costs. Cost of expediting, receiving, inspection and incoming quality control are also included.

**Direct material price**
The direct material price only consists of the purchasing price. It is important to keep in mind that this cost can be divided into other cost categories depending on what is included in a quote, e.g. transportation costs.

**Transportation costs**
All transportation costs (both internal and external) is included, the only transport not included within this area is the transportation inside the warehouses and factories. Costs associated with the transports are also included, e.g. freight taxes and custom duty.

**Overhead costs**
Overhead costs for departments such as R &D, purchasing, production, sales and financial departments. Within this category, costs such as supplier audits, support costs, communication costs and costs related to the relationship are included. All administration costs related to the product such as billing, reception of orders, salary payments and economical follow-ups is also included in the overhead costs.

**Other costs**
Other costs includes all other costs related to the make-or-buy decisions that do not fit in any other category, e.g. information systems, marketing currency costs, payment fees and end-of-life costs. It is important consider costs that do not fit in the categories, as they can affect the total costs significantly. To notify, if extra quality costs occur outside the production facilities they must be accounted for in this category.
Step 3.1 – MA cost calculation
Cardo is implementing a full cost model that the MA cost originates from. The full cost model covers several of the costs from the total cost model, but still a few of them need to be added to cover the full MA costs. The partly considered elements and the not considered elements need to be applied separately. First, the holding cost and WIP cost in the carrying cost category is not covered in the full cost model and needs to be added. These costs will be included in the full cost model in the future, but as today, it is not included. The transportation costs are only partly covered, only including incoming transports, if it is included in the price from the supplier. The transports within the facilities with forklifts are covered in the full cost model but other transport costs, internal between factories and external to customers, is not included and therefore has to be added. The other costs category is special because it includes all costs not covered by any of the other categories, but still significant enough to consider, therefore this category needs to be added. In Table 24, the categories from the total cost model are compared with the costs included in the full cost model and the costs that need to be added.

<table>
<thead>
<tr>
<th>Total cost model</th>
<th>Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing costs</td>
<td>Full cost model</td>
</tr>
<tr>
<td>Facilities costs</td>
<td>Full cost model</td>
</tr>
<tr>
<td>Direct material price</td>
<td>Full cost model</td>
</tr>
<tr>
<td>Overhead costs</td>
<td>Full cost model</td>
</tr>
<tr>
<td><strong>Other costs</strong></td>
<td></td>
</tr>
<tr>
<td>fluctuations in currency</td>
<td>Full cost model</td>
</tr>
<tr>
<td>variances from standard</td>
<td>Full cost model</td>
</tr>
<tr>
<td>inventory adjustments</td>
<td>Full cost model</td>
</tr>
<tr>
<td>price differences in inventory</td>
<td>Full cost model</td>
</tr>
<tr>
<td>additional relevant costs</td>
<td>Add to full cost model</td>
</tr>
<tr>
<td><strong>Transportation costs</strong></td>
<td></td>
</tr>
<tr>
<td>from suppliers</td>
<td>Add if not included</td>
</tr>
<tr>
<td>internal between facilities</td>
<td>Add to full cost model</td>
</tr>
<tr>
<td>to customer</td>
<td>Add to full cost model</td>
</tr>
<tr>
<td><strong>Carrying cost</strong></td>
<td></td>
</tr>
<tr>
<td>holding costs</td>
<td>Add to full cost model</td>
</tr>
<tr>
<td>WIP</td>
<td>Add to full cost model</td>
</tr>
<tr>
<td>obsolescence</td>
<td>Full cost model</td>
</tr>
</tbody>
</table>

**TABLE 24 MA COST STRUCTURE**

It is essential to allocate the correct costs to the item being compared with the BA costs. If this procedure is performed incorrectly, it is risky in a make-or-buy analysis, e.g. a product that is manufactured in-house compared with an external source can be shown as a lower cost when it actually is more expensive. This can lead to the product not being outsourced when it actually beneficent to outsource. To solve this issue Activity Based Costing (ABC) should be used, which will be implemented in Cardo in the future.

Step 3.2 – BA cost calculation
The BA cost includes all categories of the total cost model; the supplier has the same cost elements as the buying company has. These costs are included in the price; the only cost that not always is included is the transportation cost that depends on the incoterm, illustration Table 25.
Table 25 Costs That are Included in Quotes

To be able to compare the MA and BA costs, additional cost must be added to the price in the quotes. In the facilities cost category, extra cost for receiving and quality control can occur, i.e., to receive raw material can have other procedures than receiving finished components. Depending on the delivery terms, transportation cost must be added, if it is not included in the price. In the overhead cost category, it is possible that costs related to the relationship increase. To change from a raw material supplier to a finished goods supplier may change to relationship and extra cost can occur. Furthermore, holding costs will occur when Cardo owns the component/product, these will be higher than the holding costs for raw material. Therefore, holding costs must be added to the price presented in the quotes. The last category to be added is the other costs. It can always occur relevant costs that do not fit in any other category. An illustration of the discussion above can be seen in Table 26.

Table 26 Additional Internal Costs

Step 3.3 – Comparison of MA and BA Costs
When step 3.2 and step 3.3 is performed, the comparison can be executed. Notice, the MA cost can be compared with more than one BA cost; there can be more than one supplier in this stage. If the MA cost is the lowest and no other reasons to outsource exist, manufacture the item. If there are other reasons to outsource, such as gain competitive advantage and technology, etc., it is important to consider these before choosing the make alternative. Otherwise, investigate the most interesting suppliers in step 3.4.

Step 3.4 – Supplier Audit
Investigate, at least, the two most interesting suppliers with supplier audits. If the supplier has a very low score on vital aspects, an action plan has to be applied to correct these faults. It is vital to control if the supplier is approved on aspects that affect the make-or-buy decision significantly. If the supplier is approved, it is also approved for outsourcing. Therefore, the supplier audit is a knockout criterion; if the supplier is non-approved in the supplier audit, the supplier is not considered as a suitable supplier for outsourcing.

Two risks are not covered in the RAT from step 2, neither in the supplier audit because they depend on a specific supplier. These risks are covered in this step with the RAT-methodology illustrated in Table 27. The RAT-methodology is described in step 2.
External Risks | Importance for decision (Low/High) | Likelihood (Low/High) | Motivation
--- | --- | --- | ---
Contractual |  |  |  |
Imitation and worsen competitive strength |  |  |  |

**TABLE 27 RISKS CONNECTED TO THE SUPPLIER**

If the supplier is approved (both in the supplier audit and in the RAT) the risks must be compared with the total cost; if the cost saving is “worth” the risks it is recommended to buy. If the risks are too high compared with the cost saving the supplier is not optimal for the make-or-buy decision. If this is the case, another supplier must be audited and compared against the cost saving. If the risks are low compared with the cost savings, it is recommended to buy and proceed to step 4.

### 11.6 Step 4 - Relationship

The type of relationship is closely connected to power-dependency in a relationship. If a company only has one supplier of a vital product for their production, one can say that the company is highly dependent on the supplier, thus the supplier has relatively high power in the relationship. One approach to analyze a proper relationship for a company to have with a particular supplier is to make use of Kraljic’s matrix. Notice, Kraljic’s matrix should work as guidelines when a relationship should be chosen. The procedure in step 4 – relationship is: first, identify the supply and financial risks assessed for the make-or-buy item, and match this with Kraljic’s matrix. Second, identify a suitable relationship for the make-or-buy item according to the descriptions in step 4.2. The structure is illustrated in Figure 38 below.

**FIGURE 38 STRUCTURE OF STEP 4**

**Step 4.1**
According to Kraljic, the relationship is depending on the financial risk and the supply risk involved in the relationship. Financial risk is defined as the strategic importance of the purchasing in terms of the volume purchased and impact on business growth or quality. Supply risk is defined as the number of suppliers available, substitution possibilities and competitive demand. Kraljic’s model considers the combination of financial risk and supply risk, which is divided into four different quadrants in a 2x2 matrix. In each quadrant, guidance for how the company should act when choosing their supplier relationship is described. An illustration of Kraljic’s matrix is shown in Figure 39. The financial and supply risk has to be assessed for the make-or-buy objective, for evaluation in Kraljic’s matrix. After this, a proper relationship can be chosen according to descriptions stated in step 4.2. It is essential that the chosen relationship is performed in reality, i.e. “walk the talk”.

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Page 70
FIGURE 39 KRALJIC’S MATRIX COMBINED WITH RELATIONSHIP

Step 4.2
The different relationships mentioned below are defined in Appendix D.

Non-critical quadrant
In the non-critical quadrant, Cardo should use the open market to push the price down; no strategic relationship with suppliers is recommended. This is because the products are easily available from many suppliers and involves low financial risk, which is typical for standard products. The buyer can have agreements for longer periods with suppliers, to ensure the supply of products and to minimize their own workload. A suitable relationship in this quadrant is a nonstrategic transactions relationship.

Leverage quadrant
In the leverage quadrant, Cardo has to exploit their purchasing power, because there are many potential suppliers and a high purchasing value in each buy. It is recommended to purchase components, and exploit the competition in the market to negotiate a lower price. Leverage items has a low supply risk but are associated with high financial impact for the buying company. It is not suitable to have a long-term relationship with the supplier. In the leverage quadrant a contractual relationship is a preferable relationship.

Bottleneck quadrant
In the bottleneck quadrant, it is important for the buyer to secure supply, as there are a limited number of suppliers of the product. Therefore, it is recommended to establish long-term relations with the suppliers that delivering bottleneck products, to secure the supply. A partnership with the supplier is to prefer in this quadrant.

Strategic quadrant
The last quadrant is the strategic; where the products are of high financial and supply risk, i.e. there are few suppliers able to deliver and the purchase is associated with high financial risk for the buyer. In this category, it is important to secure supply via strategic relationships with the supplier, such as an alliance.
12 Reflections

Reflections over the developed model and interesting findings are presented in this chapter. The chapter is ending with suggestions of areas for further studies in the topic of make-or-buy analysis.

12.1 Conclusions

A major advantage of the make-or-buy model is that it provides a combination of a model that connects aspects related to outsourcing and identification tools for each aspect. Often, these two are separated in theory. Examples of models that connect outsourcing aspects are presented by Brandes (1994) and McIvor (2000). Identification tools are presented by Coman & Ronan (2009) and Kraljic (1983), among others. Another advantage of the make-or-buy model is the combination of theory and Cardo’s best practices, which makes the model applicable and user-friendly for Cardo. To secure the usability, several persons that will use the model have tested the model and given feedback for improvements.

There are also limitations to the model. The model’s focus is on a strategic level, i.e. an exact value that indicates if the investigated item should be manufactured in-house or bought is not the result. Instead, it provides a procedure that secures that significant aspects of make-or-buy decisions are included in the analysis. Otherwise, the decision can be taken with incorrect input. To develop a model that covers all aspects in outsourcing decisions and provide the answer of whether to make or buy, must be adapted to specific cases and cannot be generic in the same means as this model. Furthermore, in the model it is suggested to use the full cost model to cover the total cost of the make-or-buy decision. The drawback is that the full cost model is not yet implemented in the whole organization. This means that persons involved in make-or-buy decisions must find other tools to calculate the costs until the full cost model is fully implemented. It is not necessary to develop a specific tool for make-or-buy analysis when tools that will be implemented exist in the organization. This also increases the chance that the calculations will actually be performed. The full cost model must also be adjusted to the make-or-buy analysis. This adjustment is not standardized and can therefore not be explained in the model. Instead, the aspects that must be complemented in the full cost model are described, so the developers of the full cost model can implement these aspects. Before the model can be fully implemented, Cardo must test the model to secure that it provides the correct result. A non-included aspect is the identification of suitable products/components for outsourcing. Instead, the model control whether a product/component chosen by the employees at Cardo should be outsourced or not. This can lead to that products/components that should be outsourced never are considered for outsourcing.

12.2 Recommendations

Today, Cardo do not have any structured procedure for make-or-buy decisions. This can lead to important aspects in make-or-buy analysis can be excluded. If an analysis is performed with incorrect information, a buy decision of a vital component or product can be taken. In the long-term perspective, it can lead to an undermined company, i.e. Cardo can lose its competitiveness in the market. The make-or-buy model developed in this thesis minimizes these risks if it is applied. The model provides a structured method for Cardo in make-or-buy analysis that includes the most significant aspects. The model should be used as a guide when an analysis is performed. Notice, the model do not provide the answer, instead it provides a method that secure that significant aspects are included in the analysis. Four vital aspects are identified from theory: Core capability, risk, cost, and supplier relationship.

The core capability aspect sets the foundation for the make-or-buy analysis and therefore vital for the decision. Today, Cardo has not identified its core capabilities, which means that person employed within Cardo must identify the core capabilities by themselves. Instead, the core capabilities must be provided from corporate level. In the present situation it is possible that: Cardo work in the direction that the strategy implies in a
corporate level and in a factory level they work from what the factory is best on. The result of this can be that Cardo is losing the competitiveness on the market.

The risk aspect’s purpose is to secure the most vital risks in a structured procedure. In the present situation, the companies within Cardo handle risk with only the knowledge and experience of each individual. This must be performed in a structured way that takes advantage of the experience and knowledge that the employees have. The risk analysis tool developed for the model provides the combination and therefore recommended to use.

The cost aspect complements the cost calculation that Cardo performs today. To be sure that the correct data is used for the analysis, the calculation of costs must be improved. As of today, it is impossible to know if the right MA costs are compared with the correct BA costs. Therefore, the full cost model must be applied together with the total cost model presented in the make-or-buy model. The ABC allocation method must also be applied to secure that the products/components are allocated with the correct cost. Today, it is impossible to know which products that have the lowest costs.

The last aspect, relationship, provides a structured method to choose a suitable relationship with a supplier that the product/component is outsourced to. This method is well known within several sites’ daily business. The make-or-buy model point out that the method must be considered in every outsourcing decision.

12.3 SUGGESTIONS FOR FURTHER STUDIES

To improve the model, it is suggested to investigate each aspect further. To improve the core capability section, perform a focused SWOT analysis and benchmark the identified capabilities against the competitors to secure that it is the core capabilities that are identified. In the risk category, perform case studies to control if all identified risks are relevant for the make-or-buy analysis, as it is now the risks are theoretical and may not be applicable to Cardo. The case studies could also provide other relevant risks to the model. Furthermore, the method used within Cardo to control catastrophic risks has the same structure as the RAT model but are more advanced and already in use. Therefore, it is recommended to investigate if the risk associated with outsourcing can be applied in the model. The reason that this has not been performed depends on the time aspect and copyright reasons. In the costs category, the full cost model can be further studied. This is done via an investigation on how the full cost model is constructed and how it should be integrated into the make-or-buy model. Within this category, it is also interesting to investigate how an ABC method could be integrated within Cardo. The relationship aspect could be improved through more interviews focused on what aspect that is important when a relationship is chosen with the supplier. More visits at factories would secure that the model will work companywide.
BIBLIOGRAPHY


**APPENDIX A**

*In this appendix we present the literature study and what search words we used.*

**LIBRARY’S IN MALMÖ**

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**TABLE 1 SEARCHES MADE AT LIBRARY DATABASE**

**SEARCHES MADE IN BUSINESS SOURCE PREMIER**

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**TABLE 2 SEARCHES MADE IN DATABASE BUSINESS SOURCE PREMIER**

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**TABLE 3 SEARCHES MADE IN DATABASE EMERALD**
APPENDIX B

In this appendix, the interview questions used in the empirical study are presented.

Introduction

Who are you?

Position

Background

Outsourcing today

To give us an insight on what outsourcing is for you, can you tell us about what outsourcing is for you? How do you define outsourcing?

- Do you use outsourcing as a strategic tool?
  - How do you use it?
  - When do you use outsourcing as a strategic tool?
    - When a new product should be manufactured?
    - When the contracts with existing suppliers should be updated?
    - Or when you discover a problem?
  - What are the motives to this?
  - Is a goal for the outsourcing decision set up?
    - In that case, what is the goal? (Money, strong player in the market etc)

- How does your division at Cardo work with outsourcing today?
  - Which aspects do you take in consideration? (Costs, core competence, etc)
    - Which aspects is the most important?
    - Why?

- Who takes the outsourcing decision?
  - Management level?
  - Factory level?
  - Or both?

How are the different parts tied together?

Do you consider aspects in a certain order? (Costs before core competence)

Outsourcing tomorrow

- How do you want your factory/Cardo to work with outsourcing, in a dream scenario?
  - With a Team?
  - Who should take the decisions?
  - Which aspects should be included?

GENERAL QUESTIONS FOR CORE COMPETENCE

To be able to make sure that we mean the same when we say core competence, we would like you to describe your definition of core competence?

Similar terms to core competence are core activities and core capability, do you separate between these?
To gain a competitive advantage in the market, the core competence must build on the companies resources, do you investigate how products, resources, processes are connected to core competence.

Core competence is difficult to identify, we wonder how you identify core competence?

**RISK**

Are the business objectives set?

Are the objectives for outsourcing quantitative or qualitative or both?

If a team is formed, is it also included in the risk analysis? Are the members the same?

What is the objective for the team?

What factors are included in the risk analysis?

How is the process for handling risk performed? (Benchmarking, software)

How is the risk events handled when they occur?

Does the type of outsourcing change, depending on the strategic importance and the level of risk the product has?

**COSTS**

Which costs are important to consider in an outsourcing decision and do you consider these costs?

How do you divide these costs onto products?

**RELATIONSHIP**

It is important to consider the type of relationship in an outsourcing collaboration. How do you choose relationship in an outsourcing decision? Which aspects do you consider when a relationship should be chosen?
In Appendix C, incoterms are described.

Source: (Logwin AG)
The transportation costs are important when calculating the total cost. The transportation cost depends partly on delivery terms, also called incoterms. Delivery terms are about the delivery from the supplier to the buyer. The International Chamber of Commerce has defined 13 delivery terms that today function as an international set of rules. The latest version is Incoterms 2000. (International Chamber of Commerce)

Incoterms defines:

- Who is going to pay for the transport, insurance and other costs
- To what location is the transport going
- If unloading is included
- When the risk exceed from the supplier to the buyer

(International Chamber of Commerce)

This gives a numerous of different combinations of payment-terms, who handles the risk during the transportation etc. The Incoterms 2000 are divided into four groups, where every incoterm belongs to one of them. These groups are called E-Group, F-Group, C-Group and D-Group, these are explained below. For a more detailed view, see above. (International Chamber of Commerce)

**E-Group**

In this group, the buyer has all the responsibility and the buyer or a vendor hired by the buyer will collect the goods at the supplier. In this group, the incoterm called Ex-works (EXW) are included.

**F-Group**

The supplier delivers the goods to a transportation company that the buyer arranged and financed. When the goods are loaded, the risk is transferred to the buyer. In the F-Group, the incoterms called Free carrier (FCA), Free alongside ship (FAS) and Free on board (FOB) included.

**C-Group**

The same as in the F-Group, but the supplier arranges and finance the transportation. The risk transfers to the buyer when the supplier delivers the goods to the buyer, e.g. on a truck that belongs to the buyer. The incoterms are called Cost and freight (CFR), Cost insurance and freight (CIF), Carriage paid to (CPT) and Carriage and insurance paid to (CIP) included.

**D-Group**

The supplier handles all the risks and the costs until the buyer receives the goods. In the D-Group the following incoterms are included: Delivered at frontier (DAF), Delivered ex ship (DES), Delivered ex quay (DEQ), Delivered duty paid unpaid (DDU) and Delivered duty paid (DDP).
APPENDIX D

Here we present some definitions needed in model version 2 and model version 3

CORE CAPABILITY DEFINITIONS

Core capability
Core capability is the ability to use core competences and core activities within a company to create an advantage in the market.

Core competence
Core competence is the knowledge or skills behind a product or a process that is special in the market. They are also limited in number, embedded in the organization, unique sources of leverage in the value chain, flexible and are in areas where Cardo can dominate.

Core activity
A core activity is central to serve the needs of customers and potential customers.

An example to clarify the terms and the correlation between the core capability, core competence and core activity are described below

An event for ABS can be, winning a major customer order in high competition, i.e. commercial excellence. This depended on the high quality of the pump and leading technology. The high quality of the pump depends on the production activity of the impeller, i.e. operational excellence, which is a key component. The impeller is a key component because of the knowledge in development of the impeller, which is vital for the pump functionality, i.e. innovation excellence. In this way, development of the impeller is identified as a core competence that is highly dependent on the production procedure of the component, which is a core activity. The knowledge in developing and the production of the impeller creates the core capability of ABS, i.e. it creates the competitive advantage, see Figure 1. Therefore, the list of core capabilities includes the production procedure of the impeller and the development of the impeller. If the factories investigate if the production of the impeller should be outsourced, they must check with list of core capabilities. They must investigate if the outsourcing will affect core capabilities or not.

FIGURE 1 CORRELATION BETWEEN CORE COMPETENCE, CORE ACTIVITY AND CORE CAPABILITY
# Risk Definitions

<table>
<thead>
<tr>
<th>External Risks</th>
<th>Definition</th>
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<tr>
<td>Contractual</td>
<td>Consider risks related to the contract. Relevant questions to ask in this matter include whether the penalties in the contract are useful, can it be used without destroying the relationship etc.</td>
</tr>
<tr>
<td>Supplier Performance</td>
<td>Deals with issues like whether the provider is capable of doing what is agreed upon, if they have resources and capabilities enough, and if the right quality can be delivered</td>
</tr>
<tr>
<td>Imitation and worsen competitive strength</td>
<td>Occur when the supplier can provide other competitors the exact same products as Cardo’s, which can damage the outsourcing company in the end. As suppliers get more and more knowledge of the product being manufactured, the supplier may use this and begin to market this product on their own.</td>
</tr>
<tr>
<td>Commercial</td>
<td>Related to the price and cost that should be paid for the outsourced work, in outsourcing it is easy to lose the price knowledge. It also includes extra costs that may occur when the company outsources.</td>
</tr>
<tr>
<td>Loss of innovation</td>
<td>A risk that occurs when parts of the company related to innovation or development is outsourced, which may lead to the company’s innovation or development skills are falling.</td>
</tr>
<tr>
<td>Double costs</td>
<td>It is very important to clear related activities after the outsourced activity, otherwise can this lead to double costs. In many cases companies tend to forget to do their internal work and just focus on the external connection to the supplier</td>
</tr>
<tr>
<td>From doing to buying</td>
<td>When the company should change from doing to buying and not able to handle the new area.</td>
</tr>
<tr>
<td>Loss of cross functional skills</td>
<td>A condition in which the company loses their opportunity to work with different people from different functions or activities within the company</td>
</tr>
<tr>
<td>Be able to take activity back in-house</td>
<td>When activities disappear, from the company it will be harder to keep that knowledge within the company and it will be hard to take it back in-house again.</td>
</tr>
<tr>
<td>Loosing other knowledge</td>
<td>The knowledge within the company can be lost when products/components are outsourced.</td>
</tr>
<tr>
<td>Hidden costs</td>
<td>All costs related to outsourcing are hard to identify, hidden cost could occur.</td>
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<tr>
<td>Loss of organizational trust</td>
<td>A situation where the employees no longer have confidence in the organization</td>
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<table>
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<tr>
<th>Internal Risks</th>
<th>Definition</th>
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<td>Investment</td>
<td>Occur when the company needs to invest to keep up in the market. It is not or sure that the desired volume is reached.</td>
</tr>
<tr>
<td>Double costs</td>
<td>When a new machine is bought and the old machine is not disposed it can occur double costs</td>
</tr>
<tr>
<td>Worsen competitive strength</td>
<td>If there is a lack of innovation, or that the company missing technologies to be in front of the market.</td>
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**Table 1: External and Internal Risk Definitions**
COST EXAMPLE

To illustrate a total cost approach the following example is created. Two alternatives are first described and then compared. In alternative A, a component is produced in-house in two machines, X and Y. The raw material for the production is ordered from a supplier that delivers to the buyer’s goods reception. The goods reception controls the raw material regarding quality, and stores the raw material into the inventory (RMI) until it will be manufactured. Alternative B is to buy the component from a supplier and not produce the component in-house. This is illustrated in Figure 1 and Figure 2.

Each of the alternatives has different costs associated to them that are described according to the flow of goods below.

**Alternative A**

First, the order is placed to the supplier, which demands administrative work. The supplier sends the goods to the goods reception and transportation costs occur. In some cases, the transportation costs are included in the price from the supplier and sometimes it is not. When the goods arrives at the goods reception, personnel has to receive the goods, and control the quality, quality costs and receiving costs must be added to the total cost. After the quality control, the goods are stored in the raw material inventory until it is needed in the production; it occur carrying costs. The next procedure is the processing in machine X and Y, where personnel and production costs occur. After machine X and Y the goods have to be stored, meaning that carrying costs occur. When the component is transported in supply chain, between inventories and machines, it arise transportation costs. The direct material price is also added. All costs in alternative A are summarized in the bullet list below:

- Overhead costs
  - Administration of transportation
  - Administration of order
- Transportation costs
  - Inbound transports
- Facilities cost
  - Internal transports
  - Incoming quality controls
  - Goods reception
  - Machine-costs for machine X and Y
- Manufacturing costs
  - Direct labor for machine X and Y
  - Direct material cost (raw material)
- Carrying costs
  - RMI
  - 2 WIP
- Direct material price
Alternative B
The flow in alternative B is similar to alternative A. When ordering from the supplier, it demands administrative work, such as administration of the order and transportation. When the goods arrive at the goods reception, the same work has to be performed as in alternative A, i.e. goods reception and quality control. After this, the goods are sent directly to the WIP after machine Y. In the WIP, it occurs carrying costs. For the transportation, a transportation cost must be added to the total cost. Direct material price must also be in the total cost and is therefore added. The costs for alternative B are summarized in the bullet list below:

- Overhead costs
  - Administration of transportation
  - Administration of order
- Transportation costs
  - Inbound transports
- Facilities cost
  - Internal transports
  - Incoming quality controls
  - Goods reception
- Manufacturing costs
  - Direct material cost
- Carrying costs
  - 1 WIP
- Direct material price

Comparison
Each cost has to be quantified and compared to identify which of them that is the lowest. The overhead costs are rather similar but in alternative B a more complex product is bought that might demand more administration. The inbound transportation costs in both cases will probably be the same, if the size and weight of the goods are similar. Otherwise, the transportation cost will differ. The facilities costs will be different, because of a reduced amount of internal transportations in alternative B. Furthermore, the machine-cost do not occur in alternative B. If the product in alternative B are more complex it will probably need more extensive quality controls than alternative A. The manufacturing costs will also be different, in alternative A the direct labor for machine X and Y occur and this is not the case in alternative B. Carrying costs are also different between the two because in alternative A two more storages (RMI and 1 WIP) occur. Lastly, the price of the raw material and the price of the component is not the same.

RELATIONSHIP DEFINITIONS

<table>
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<th>Relationship</th>
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<td>Nonstrategic transactions</td>
<td>Standardized products and relationships are transaction-orientated with low critical activities. This means that there are no needs for deeper relations.</td>
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<tr>
<td>Contractual relationships</td>
<td>Greater control over business and supplier is needed than in the Nonstrategic Transactions. The critical level is still low and there is a dependency situation between the parties.</td>
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<tr>
<td>Partnership</td>
<td>Critical activities where there are rather few suppliers. The activities have a high critically. A strong trust between buyer and supplier, as well as a strong commitment to the relationship.</td>
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<tr>
<td>Alliances</td>
<td>Outsourcing of critical activities were the products are of high strategic importance. A need for deeper relation exists and the relationship is often very strong. Few existing suppliers.</td>
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APPENDIX E

In Appendix E, the telephone conference questions are presented.

Telephone conference

Do you understand what aspects the model highlights and how they are connected to make-or-buy analysis?

Is the overview of the model user-friendly?

The picture of the model, does it give a clear overview?

Is the core capability aspect user-friendly?

Is the risk aspect user-friendly?

Is the cost aspect user-friendly?

Is the relationship aspect user-friendly?

Is the information in the model correct?

Is the layout of the model user-friendly?

Is the amount of text ok?

Is anything missing in the model?