

# Total Cost of Purchasing at Duni AB: Development of a Cost Model

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# Abstract

## *Background*

Through global competition with possibilities for companies to set up production and to secure supply from all over the world the role of purchasing has increased within businesses. In order to achieve business results, a well-working purchasing department plays an important part. To contribute, the purchasing function should not only focus on getting the cheapest price possible, but to take part in shaping strategic directions for their corporation.

## *Problem*

Duni AB and the business area Meal Service has recognized opportunities in developing their sourcing work by bringing a wider cost focus into their work. By this, they think that they could identify cost saving areas and validate that they make the right decisions based on more aspects than they are doing today. The main objective was therefore to develop a cost model including multiple cost elements besides the purchasing price.

## *Purpose*

The purpose of this study is to create a cost model that Duni Meal Service can use in sourcing and economic life cycle decisions, showing a holistic view of the total cost of purchasing.

## *Method*

Since the objective was to develop and deliver a purchasing cost model to Duni Meal Service a constructive research approach was applied. The focus was on bridging theory and practice and an interview study was held at the principal company, to gain practical knowledge and insight. This together with the theoretical framework, created from our literature studies, worked as a foundation in the analysis and the development of the cost model, as well as for further recommendations given to Duni.

## *Theory*

Purchasing Management was investigated, including theory about supplier selection and cross-functional integration. Literature about trade companies was also sought for, since this thesis is limited to traded goods at Duni. In addition, a section of Purchasing Measurements was added since it was mentioned that this might be one of the background issues at Duni. Furthermore, a set of purchasing cost models have been researched and presented. These models are Total Cost of Ownership (TCO), Activity-based Costing (ABC), Landed Cost and Life Cycle Costing (LCC). When the cost models were studied the objective was to find information regarding the following areas: general information, cost elements and cost drivers, applications and success factors. These areas were then summed up and discussed in order to find some patterns in the literature.

## *Empirical Data*

All empirical data collection was made at the principal company, Duni, by interviewing a lot of employees from various functions and at different levels in the business. The focus areas in the interviews were the same as during the literature review: general information, cost elements and cost drivers, applications and success factors. The interviews were mainly held with people from the business area Meal Service or from the Supply Chain department, including the warehouse and logistic functions.

## *Analysis & Conclusion*

Some conclusions were made when comparing the theory with the empirical data in order to find the best possible solution for Duni. It was decided which cost elements and cost drivers to involve in the cost model development and it was also analyzed which the typical application areas of the cost model should be. It was clear that the theory and empirical data were aligned at many areas but the scope of this thesis did not suit all of the studied cost models.

### *The Cost Model*

To fit the needs at Duni Meal Service a Duni specific cost model was created. However, this cost model has almost all the same characteristics as a Landed Cost model and can be seen as a limited version of it. The cost model covers the stages from the point where Duni takes over the ownership of a product from the supplier, via the inbound logistics into the warehouse, and then all parts of the warehousing. Outbound logistics is not involved. The cost model should be used in various sourcing decisions as well as product life cycle decisions such as phase in or phase out decisions.

The cost model was created in Excel and along the cost model a user guide and a model manual was developed. Also further guidelines and recommendations were provided in order to successfully implement and maintain the cost model at Duni. Some of the recommendations were that they need to work more cross-functional at Duni in general and that they should align the KPIs to the corporate strategy and take actions accordingly, based on the information provided by the cost model.

### *Key Words*

*Purchasing cost model, purchasing management, sourcing decision making, landed cost, total cost of ownership, activity-based costing, life cycle costing, purchasing measurements, economical life-cycle decision*

# Sammanfattning

## *Bakgrund*

På grund av att företag idag har möjlighet att konkurrera globalt genom att flytta produktionen utomlands och att säkra leveranser ifrån alla världens hörn har också inköpsfunktionens roll förändrats. För att nå företagets uppsatta mål är det viktigt att ha en väl fungerande inköpsfunktion som jobbar effektivt. Inköpsfunktionen bör inte enbart fokusera på att uppnå det billigaste möjliga inköpspriset, utan också bidra i de strategiska beslut som påverkar hela företaget.

## *Problem*

Meal Service, som är ett affärsområde inom Duni AB, har identifierat en möjlighet att utveckla deras inköpsarbete, genom att börja arbeta med ett bredare kostnadsfokus. Genom detta, hoppas de kunna identifiera fler kostnadsbesparingsmöjligheter samt ta bättre inköpsbeslut som grundar sig i fler aspekter än vad de använder sig av idag. Därför har huvudsyftet med detta projekt varit att utveckla en kostnadsmodell som även inkluderar kostnadselement utöver inköpspriset.

## *Syfte*

Syftet med denna studie är att skapa en kostnadsmodell som Duni Meal Service kan använda i inköpsbeslut samt beslut rörande en produkts ekonomiska livscykel, genom att visa en holistisk bild av den totala kostnaden av ett inköp.

## *Metod*

Eftersom syftet med denna studie var att utveckla och leverera en kostnadsmodell för inköp hos Duni Meal Service, användes en konstruktiv forskningsmetod. Fokus låg på att länka samman teori och praktik och en intervjustudie gjordes på Duni för att få praktisk förståelse och insikt. Tillsammans med det teoretiska ramverket som skapades genom litteraturstudier, låg detta till grund för analysen och utvecklandet av kostnadsmodellen. Även de framtida rekommendationer som har getts till Duni baserades på den empiriska och teoretiska kunskapen.

## *Teori*

Inköpsfunktionens olika delar har undersökts, innefattande teori om leverantörssval och tvärfunktionell integration. Även litteratur gällande handelsföretag eftersöktes eftersom att denna studie är begränsad till inköp av färdigt gods. Det lades också till en sektion om mätsystem för inköp eftersom att detta hade nämnts som ett av de bakomliggande problemen på Duni. Vidare undersöktes och presenterades några kostnadsmodeller för inköpsaktiviteter. Dessa modeller är: Total Cost of Ownership (TCO), Activity-based Costing (ABC), Landed Cost och Life Cycle Costing (LCC). När dessa studerades var målet att hitta information inom de följande områdena: generell information, kostnadselement och kostnadsdrivare, tillämpningar och framgångsfaktorer. Dessa områden summerades sedan upp och diskuterades för att se om det fanns något mönster i litteraturen.

## *Empirisk Data*

All insamling av empirisk data gjordes hos uppdragsgivaren, Duni, genom att hålla intervjuer med anställda från olika funktioner och nivåer inom företaget. Fokusområdena under intervjuerna var desamma som under litteraturstudien: generell information, kostnadselement och kostnadsdrivare, tillämpningar och framgångsfaktorer. Intervjuerna hölls framförallt med personer inom affärsområdet Meal Service samt inom Supply Chain-avdelningen, inklusive lager- och logistikfunktionen.

## *Analys & Slutsatser*

Under analysen av det teoretiska ramverket och den empiriska datan, med syfte att hitta den bästa tänkbara lösningen för Duni, kunde några slutsatser dras. Det bestämdes vilka kostnadselement och kostnadsdrivare som skulle involveras i utvecklandet av kostnadsmodellen och det undersöktes också vilka tillämpningsområden modellen framförallt skulle fungera för. Det var tydligt att teorin och den

empiriska datan överensstämde på många områden men ramarna för den här studien lämpade sig inte för alla de studerade kostnadsmodellerna.

### *Kostnadsmodellen*

För att passa behoven på Duni Meal Service utvecklades en Duni-specifik kostnadsmodell. Dock har denna modell stora likheter med en Landed Cost-modell och kan betraktas som en begränsad version av en sådan. Den utvecklade modellen innehåller stegen ifrån det att Duni tar över ägandeskapet för en produkt, vidare genom den ingående logistiken in i lagret, och slutligen alla delar av lagerhållningen. Utgående logistik till kund ifrån lagret är inte inräknat. Kostnadsmodellen ska användas i olika inköpsbeslut samt i produktlivscykelbeslut såsom infasning och utfasning.

Kostnadsmodellen skapades i Excel och tillhörande användarguide och modellmanual utvecklades också. Vidare riktlinjer och rekommendationer gavs också till Duni för att modellen ska kunna implementeras och bibehållas på ett framgångsrikt sätt. Några av rekommendationerna var att de generellt behöver arbeta med tvärfunktionellt på Duni samt att de ska se till att de länkar samman sina KPIer med företagsstrategin och tar beslut därefter, baserat på information som fås ur kostnadsmodellen.

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## Dictionary

Cost element – a cost that is affecting the total cost of a product

Cost driver – a driver that is influencing one or more cost elements

Economical life cycle decisions – decisions related to if a product should be included in the Duni product portfolio or not, i.e. decisions about phasing in/out.

Steering group – a group of managers at Duni put together with the purpose to simplify the work of this thesis, both when it comes to resources and decision-making. Information about the members of the steering group can be found in *Appendix 1*.

Meal Service – a business area within Duni

MOQ – minimum order quantity

MPQ – minimum production quantity

DOI – days of inventory

KPI – key performance indicator

TCO – total cost of ownership

ABC – activity-based costing

LCC – life cycle costing



# 1 Introduction

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*This first chapter describes the background of this thesis, including which problems the principal company are facing today and why this thesis is relevant for them. Furthermore, the purpose, research questions, scope and delimitations are described in order to clarify. Finally the chapter ends with an outline of the thesis.*

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## 1.1 Background

The role purchasing has within companies today is way different from the role it had many years ago. Earlier purchasing was important mainly to secure supply to the cheapest price possible, today purchasing is taking a larger part in shaping strategic directions for corporations (Skjøtt-Larsen & Schary, 2008). More and more companies have realized that an effectively and efficiently working purchasing department can contribute in an important way to business results (van Weele, 2014).

Since companies today spend more than half of their sales turnover on purchased parts (van Weele, 2014), many companies also feel the importance of having improved relationships with their suppliers. This in order to develop more innovative products, get a faster time-to-market, just-in-time delivery and less defects (van Weele, 2014). This development depends on various things but the global competition with possibility to set up production and to secure supply from all over the world is a major reason (Skjøtt-Larsen & Schary, 2008).

Duni AB<sup>1</sup> is the leading supplier of innovative table-setting concepts and packaging solutions. With the vision to *"bring goodfoodmood to where people meet and eat"* they have the number one market position in Central and Northern Europe and they sell their products in 40 markets. The Duni AB headquarter is located in Malmo, Sweden and they have production units in Sweden, Poland and Germany. Furthermore they have a lot of sales offices around the world and in total they are 2100 employees in 18 countries. Duni AB is listed at NASDAQ Stockholm (Duni AB, 2015a).

This thesis focuses on the business area Duni Meal Service (MS) that is standing for 15% of the total sales of Duni. Meal Service is focused on traded goods, which means that the products they sell are the same that they buy with no internal value add. Most of their products are transported to a warehouse in Bramsche, Germany, where they are stored before they are delivered to the customer. The suppliers are located in Asia and Europe and the products are transported to the warehouse with sea freight from Asia and with trucks within Europe. Furthermore, the central Production & Supply Chain function will play an important role in this thesis as a head source of data. The Production & Supply Chain function consists of the following areas: Manufacturing, Supply Chain Planning, Logistics and Value Chain Management.

In line with recent development trends, Duni AB are currently going through a transformation from being a local medium large company to growing into an international company with a number one position on the market in many different countries. A growth like this includes a lot of changes for the organization and Duni are currently in the process of preparing their organization for these changes. They have already started this process and a part of it includes the development and building of a new purchasing function. In this transformation, Duni have identified some current issues that are visualized in Figure 1.

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<sup>1</sup> A more detailed description of Duni AB can be found in chapter 2 *Principal Company Description*.

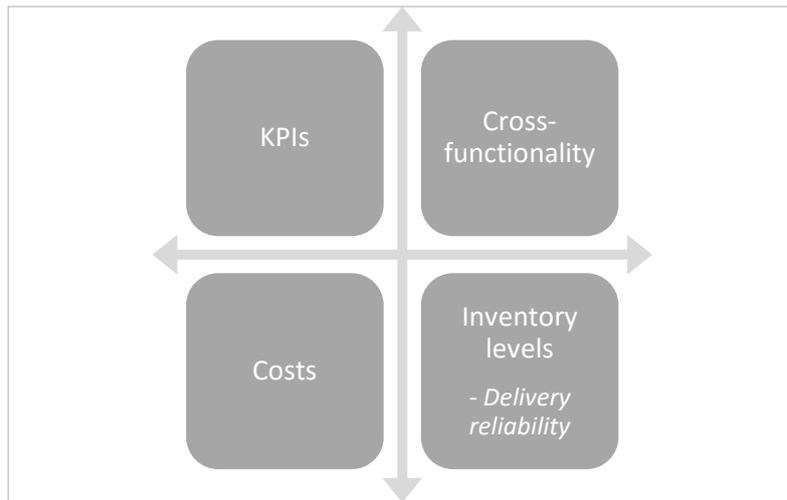


Figure 1. Background issues at Duni AB.

First of all, when investigating if they currently are using the right approach and information when doing their sourcing decisions they have realized that they are not including all relevant information of how a product really contributes to their business. Today they only include raw material cost, trade costs and transport costs when deciding if a product should be included in the product range or not. For some products this could give a miss-leading picture since things like customization, high inventory levels and other product-specific costs could affect the products differently. Apart from sourcing decisions, this could also affect the situation later on in the value chain. Decisions regarding economic life cycle should neither be based upon incorrect cost information, as it is today.

Secondly, they are using different Key Performance Indicators<sup>2</sup>, KPIs, which are misaligned, without any clear priority between them, and where the interrelation is unclear. One example is that some of the sourcing managers might buy large volume of products to a very low price without taking into account the large inventory levels and costs it can lead to. From the perspective that sourcing later on is measured on, it looks like they have done a lot of cost savings by bringing the purchase price down. Still, for the business as a whole, this might not be good from a total cost of purchasing perspective, since the high volumes can result in higher inventory and warehousing costs that exceeds the cost savings made in the first place. Furthermore, in this example, it is later on the KPIs of the logistics department that is affected by the sourcing manager's actions. The logistics department might show off bad KPIs due to this, and another issue seems to be that the organization looks at the problem as if it is up to the logistics department to improve their KPI then. It seems, as the KPIs are not established based upon the whole system and how the different departments are affecting both each other and the corporate objectives.

Thirdly, Duni has done some investigation that shows that they have a very high (>99%) delivery reliability to some customers. One suspected reason for this is that their forecast bias for these customers also is very high, i.e. the forecasted demand is exceeding the actual needs. The forecast is in turn based on, probably, over-optimistic sales estimates. Good customer service is important, but what is the actual cost of having all these products in inventory? This is a question that Duni do not have the answer for today.

Finally, as a contributing factor to all above-mentioned problems, Duni has recently started to work more cross-functional which in the initial phase have led to the identification of gaps in the organization, both between functions and between roles. They also have some issues with the communication and interaction between functions, leading to lack of transparency within the organization.

<sup>2</sup> More information about KPIs can be found in section 4.5.5 *Key Performance Indicators, KPIs* .

As a consequence of all above-mentioned problems Duni initially had the idea of carrying out a Total Cost of Ownership analysis in order to get a better overview over their spends and get joint measurement that covers the supply process. As a continuation of this cost analysis they then wanted a model that they can use in their future sourcing decisions to make sure that they are doing their choices based on correct and relevant information. However, because of the knowledge that a TCO analysis can be hard and time-consuming to do (Ellram, 1994) and the fact that Duni are not using activity-based costing today, it was discussed whether the purpose of this thesis should be to do a proper TCO analysis. It was decided that a part of the study would be to investigate if a TCO, or another purchasing cost model, was suitable for Duni's need, or if it was better to create a Duni specific cost model.

## 1.2 System

A system-description was created in order to simplify the understanding of this thesis. The system is shown in Figure 2 below.<sup>3</sup> The system is based on the current situation at Duni and developed to get a more visualized picture of the problem. The background issues, the product flow and the output they are aiming for make up the studied system. The system-description was created during the pre-study phase of this master thesis.

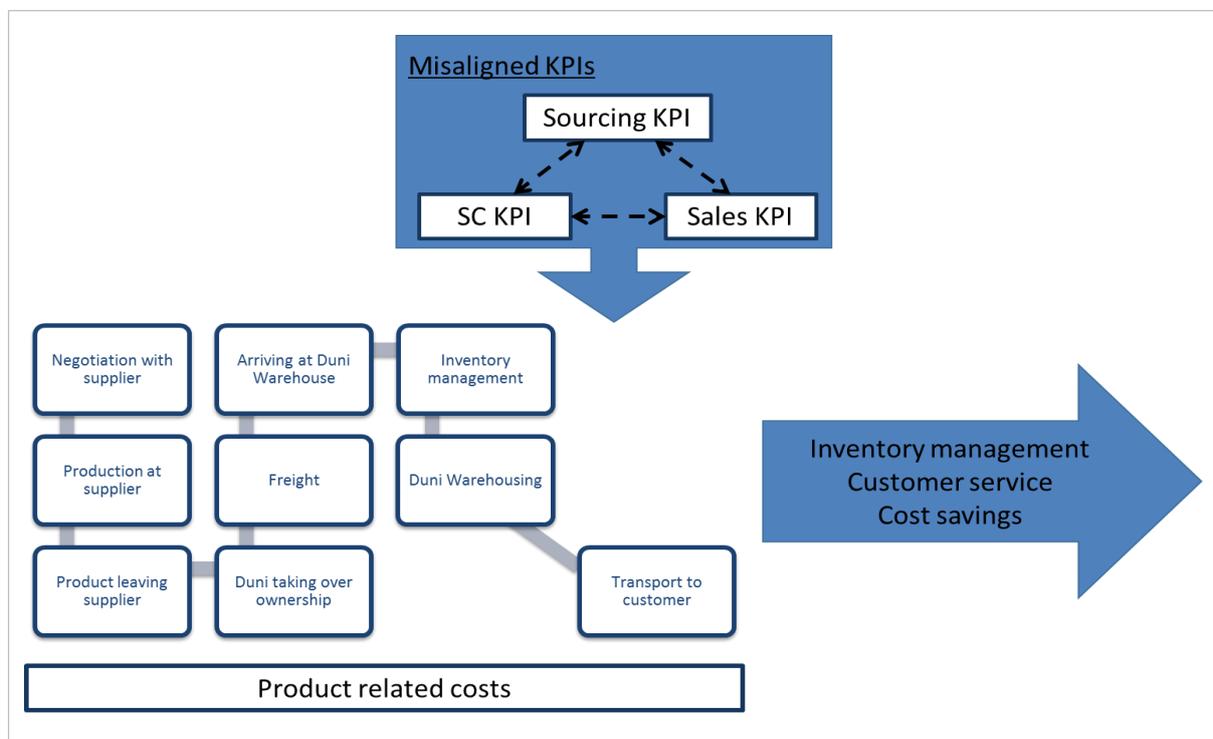


Figure 2. System description.

## 1.3 Purpose of the Study

The purpose of this study is to create a cost model that Duni Meal Service can use in sourcing and economic life cycle decisions, showing a holistic view of the total cost of purchasing.

## 1.4 Research Questions

An overall research question has been developed to this master thesis. Furthermore, two sub-questions were developed in order to support the overall question. The overall research question (RQ) and the sub-questions (RQ1 and RQ2) are as follows:

RQ: How to successfully develop and implement a suitable purchasing cost model at Duni?

<sup>3</sup> More information about when the system was created can be found in section 3.5.3.1 Pre-study.

RQ1: Which are the relevant cost elements and cost drivers to take into consideration when doing sourcing and economic life cycle decisions at Duni Meal Service?

RQ2: Which are the key critical success factors according to literature in order to successfully implement a purchasing cost model?

## 1.5 Focus & Delimitations

### 1.5.1 Directives

Duni Meal Service has requested a purchasing model suited for sourcing and economical life cycle decisions. The directive is therefore to create the requested model for Meal Service specifically. However, since the Production & Supply Chain function is a central function and is one of the head sources of data, this function will also be investigated and used in the research.

This thesis has been assigned a steering group at Duni that will be a resource throughout the project time. The purpose is that this group can take fast decisions of the directions of this thesis and to take part in various discussions during the project. The members of the steering group are both from the Meal Service business area and also the Production & Supply Chain function in order to make sure that the outcome of the project will benefit Duni at a cross-functional level<sup>4</sup>.

The priority will be on creating a Duni specific cost model that can work as a basis for a further development of a full-scale sourcing tool connected to all relevant data systems within Duni.

The products that should be analyzed are limited to traded goods, which mean that no production costs will be considered. This means that we will look at the processes from a perspective of a trade company<sup>5</sup> rather than a producing company. Another directive from Duni is that the cost focus should be on when the products are in-house, which means that we only will focus on costs from the point when the products become Duni-owned (by Incoterms), further into the warehouse and then until the products leave the warehouse, so not the transport further out to the customer, as shown in Figure 3. However, when analyzing the drivers of all these cost parameters a wider scope will be taken into consideration.

As seen in Figure 3, this means that the issues connected to product related costs, misaligned KPIs and inventory management will be our main focus, with the cross-functionality and communication issues as underlying reasons that will be improved as a natural consequence of this project.

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<sup>4</sup> The members of the steering group and their respective roles are described in *Appendix 1*.

<sup>5</sup> More information about the characteristics of a trade company can be found in section *4.3 Contextual Aspects for Trade Companies*.

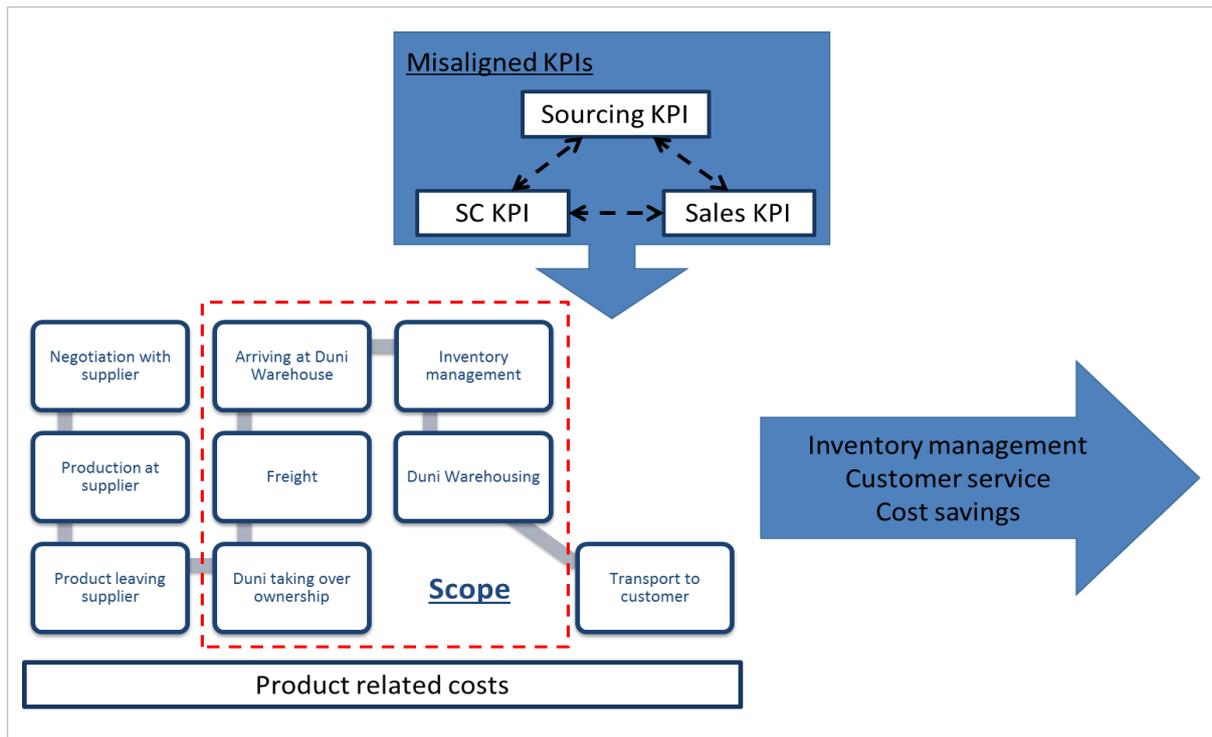


Figure 3. System description including scope.

### 1.5.2 Delimitations

Duni Meal Service has their products located at two main storage locations: Germany, connected to their own warehouse in Bramsche and some external warehouses there, and in Norrköping, Sweden. This thesis will only focus on the Germany warehouses to start with since these together make up for the largest storage for Duni and the warehouse in Bramsche is considered to be the central warehouse.

Further, due to the fact that this is a master thesis, the time is limited to 20 weeks. Areas that cannot be concluded within this time will be proposed for future research opportunities. Duni has also requested a final presentation at the Malmö headquarter after 15 weeks, which gives a further time limitation.

### 1.6 Target group

This thesis is aimed for the stakeholders at the principal company Duni, so that they find it contributing to their business. It is also relevant for master students and other persons interested in the topics logistics, purchasing and supply chain management.

### 1.7 Outline of this Thesis

In the next chapter of this thesis a more detailed description of Duni AB, the principal company, follows. Firstly Duni will be introduced in a general matter followed by some specific information about the business area Meal Service, the purchasing function within Meal Service and the Supply Chain function. Organization charts will be provided in order to describe the organizational structure. The purpose of this chapter is to give the reader, not already familiar with the principal company, a better view of Duni AB and the essential functions of this thesis.

In chapter three, the used methodology will be described in detail. The chapter starts with descriptions and definitions of the different approaches used to support the thesis work. Furthermore the various activities in the method are explained and how the validation was made in order to create credibility for the thesis.

In the fourth chapter, the Theoretical Framework is conducted. It contains theory about purchasing management, various purchasing cost models and also some additional contextual aspects. The purchasing management section contains theory about cross-functional integration, general tasks and problems with the function, how to measure performance and how to do savings within the purchasing function. Further on into the cost model section the models are all described with the following dimensions as a base, in order to make it easier to compare them:

- Cost elements
- Cost drivers
- Application
- Success factors

Moreover, the fifth chapter of this thesis consists of the empirical data. An interview study was carried out in order to find relevant information regarding Duni. The findings from the interviews are presented per department to get a natural separation of it. The findings from different functions within the same department are then summarized to get a better overview. These findings are then discussed and the chapter ends with a synopsis of what key findings that have been made in the empirical study.

Chapter six is the analysis part of this master thesis. The analysis is done through comparison between the key takeaways from the theoretical framework and the findings in the empirical study. The analysis is divided into discussions regarding general information, cost elements and drivers, the application of a cost model, the success factors for it and findings regarding performance measurements. These analyses then work as a base for the next part of this study, the construction of the purchasing cost model. In the end some overall findings from the analysis are presented.

The seventh chapter of this thesis consists of the construction of the cost model. In this chapter a detailed description is made, both about the construction process behind the model but also about how the cost model is built up. Some pictures are presented, showing the actual layout of the finalized cost model and all parameters involved in the model are described in detail.

The thesis is finalized in the eighth and last chapter where the conclusions are given. They summarize the outcome of this study and present further recommendations of this thesis.

## 2 Principal Company Description

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*This chapter describes the principal company Duni AB in a more detailed way. First some background information about the Duni history is presented followed by what customers and products that the Duni's business consists of. Then the different business areas within Duni are presented and a more detailed description about the function Meal Service and the Production & Supply Chain function finalizes this chapter.*

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### 2.1 History

Duni's first product, the waxed paper cup, was invented 1914 by Dr. Crumline, an American doctor who created an easy and inexpensive way to prevent the Tuberculosis disease from spreading. This by inventing a hygienic disposable cup made out of paper, so that the patients didn't need to drink water from the same glass and thereby share bacteria's.

35 years later, Marcus Rosendal, managing director at Billingsfors Bruk (which later became a part of Duni), was visiting the US and immediately recognized the business opportunity when he saw a paper cup in the style of Dr. Crumline's. He bought two American manufacturing machines and installed them in Dals Långed, Sweden where the production of the waxed paper cups began. This was year 1949. Since then Duni has grown to an international company with a wide range of products, all from paper cups to plastic take-away boxes (Duni AB, 2015a).

### 2.2 Customers & Products

The customer base of Duni is represented in three main groups. The first one is *"For your home"*, where the purpose is to make table-setting at home quick and fun for everyone. These products are sold in grocery stores and interior designs stores i.e. and are available for all consumers. The second customer segment is *"Restaurant & Hotel"*, where Duni provides hotels, restaurants and catering companies with premium table top and serving products. The third customer group is *"Catering & Take-Away"* where Duni offers a range of food containers for ready meals to take out restaurants and caterers. They also offers the concept Duniform®, which is a packaging machine used to seal Duni food containers. Finally, both within *"Restaurant & Hotel"* and *"Catering & Take-Away"* there is a possibility for the customers to customize their products in order to strengthen and enhance their brands (Duni AB, 2015a).

### 2.3 Business Areas

Duni organization is divided into five business areas based on customers and product types. These five areas are Table Top, Meal Service, Consumer, New Markets and Materials & Services as shown in Figure 4. This thesis will be focused within the area Meal Service, and no further description will therefore be given about the other segments (Duni AB, 2015a).

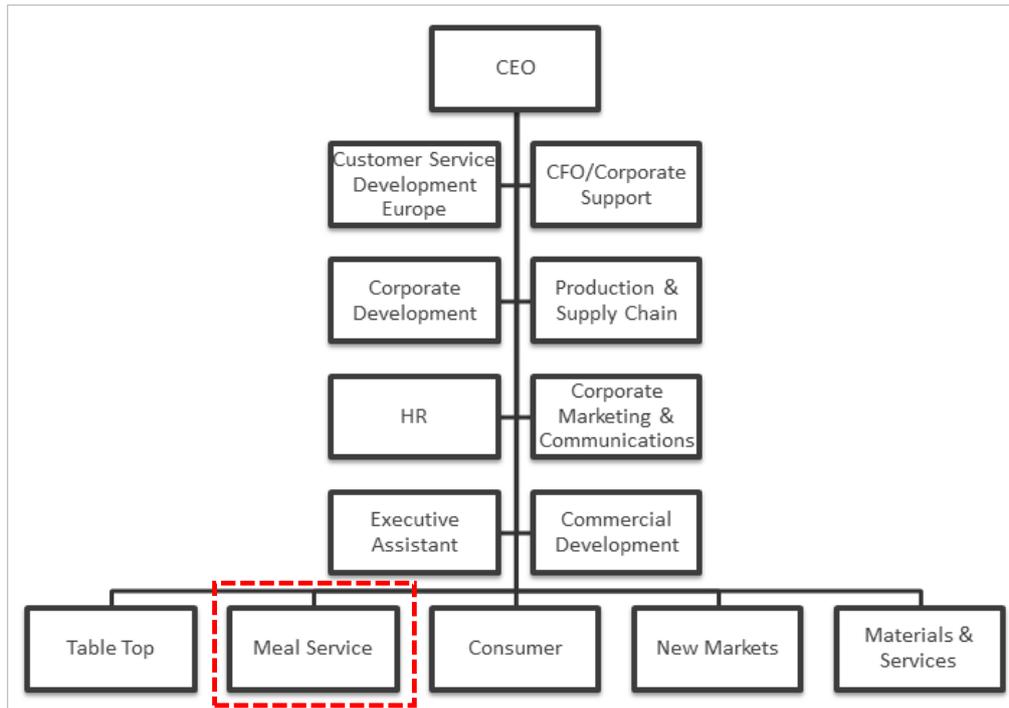


Figure 4. Organization chart Duni AB, including the five business areas.

## 2.4 Duni Meal Service

Meal service is the third largest business area within Duni, with 15% of the total sell. In 2014 Duni Meal Service generated sales of 555 MSEK, a number that is expected to grow when the year 2015 will be summed up. The sale split per region is approximately Nordics 52%, Central Europe 31% and South & East Europe 17% (Duni AB, 2015b).

Meal Service provides the food service industry with a broad range of food containers for ready meals. The product range is from sandwich boxes to thermal soup bowls and the customers are in example take-out restaurants, deli counters, industrial kitchens and caterers. Meal service also provides the market with the concept Duniform® which is a packaging machine used to form, seal and reseal Duni's take-away containers (Duni AB, 2015a).

Meal Service focuses on using unique materials and also has a strong focus on trends and new designs. They have a high renewal rate in the product range and all new products and materials are at the forefront of reducing the environmental footprint. Within Meal Service they offer both Duni branded standard products as well as customer unique products (Duni AB, 2015b).

### 2.4.1 Sourcing Team

The sourcing team within Meal Service consists of five persons: one senior sourcing manager and four sourcing managers. The sourcing managers role is to handle the strategic purchasing work including negotiating with suppliers, find new suppliers and set up general agreements. When all these strategic decisions are done, the operational purchasing work is done within the Duni central Production & Supply Chain function. See Figure 5 for the Sourcing Organization chart.

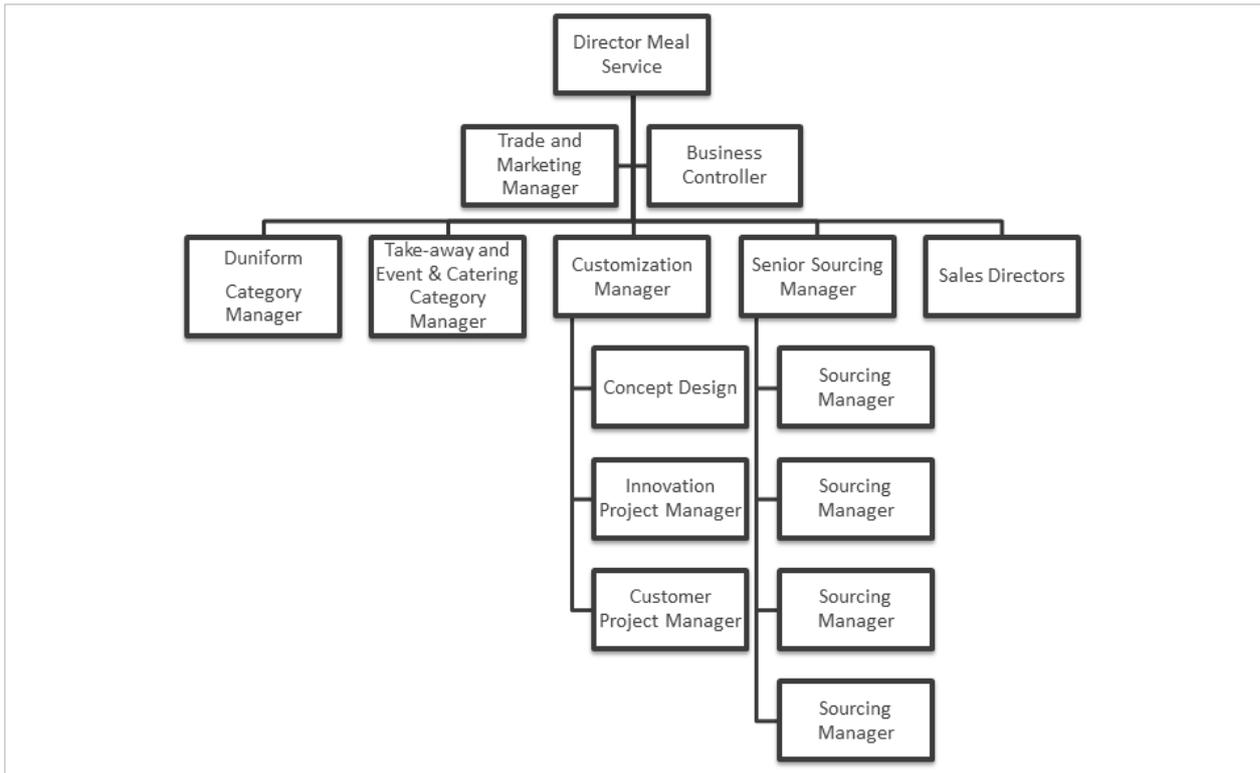


Figure 5. Organization chart for the business area Meal Service (Duni AB, 2015b).

A majority of the products within Meal Service are traded goods, which means that the product purchased from the supplier is the same product that is sold to the customer. Most of these products are transported to a warehouse in Bramsche, Germany, where they are stored before they are delivered to the customer. The suppliers are located in Asia and Europe and the products are transported to the warehouse with sea freight from Asia and with trucks within Europe.

#### 2.4.2 Category Managers

As can be seen in Figure 5 the category managers play an important role in the Meal Service Business area and they are also an important function in this thesis. The category managers' role is to be the link between sales and the sourcing team. They are responsible for the product assortment and they are the ones taking decisions about phasing in or out products. Furthermore they are involved in various product development projects and responsible for marketing campaigns.

#### 2.5 The Production & Supply Chain Function

Duni finds it crucial to have a well-working Supply Chain function in order to deliver the right products in the right place in time in a cost efficient way. They also see an efficient Supply Chain as the enabler to keep capital tied up at low levels by managing inventory levels in a balanced way and as a consequence free up cash for Duni to spend in other areas. The Supply Chain within Duni reaches from Duni's suppliers to their customers (Duni AB, 2015c). The Production & Supply Chain function at Duni consists of the following areas: Manufacturing, Supply Chain Planning, Distribution and Warehousing. An organization chart of the Production and Supply Chain function can be seen in Figure 6, where Distribution and Warehousing are a part of Logistics.

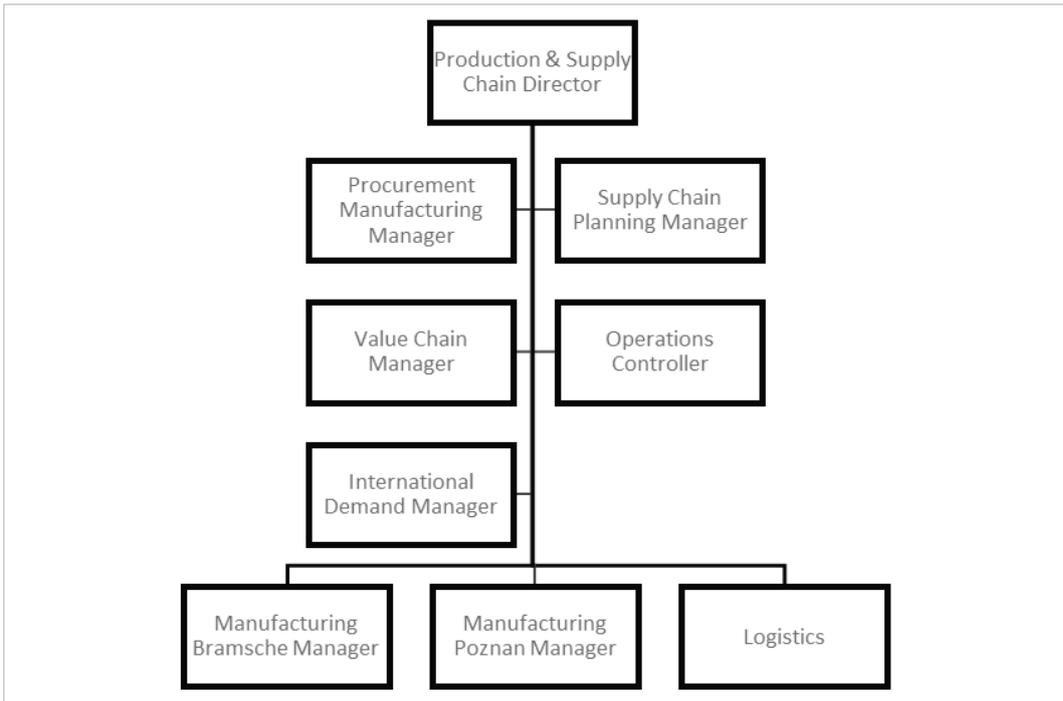


Figure 6. Organization chart for the Production & Supply Chain function (Duni AB, 2015c).

## 3 Methodology

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*This chapter describes the approach taken to make progress in this thesis. Firstly, the research methodology and research approach are defined, followed by the method used including data collection, analysis and how validity and reliability were created.*

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### 3.1 Research Methodology

The reason for a method discussion is to be able to achieve the aim of the thesis as well as possible. Depending on what the aim of the research is you have to consider what possible methods that can be used. Since there almost always is a lack of time, money or some other resource the next step is to apply the method alternative that fulfills the aim, with regards to the lacking resource, in the greatest way (Björklund & Paulsson, 2014). Furthermore Arbnor and Bjerke (1997) stated that a suitable method is not to be determined only by the problem at hand. They explained how different methodological views make different assumptions about the reality they try to explain and understand. Thus, the approach chosen will have a high influence on observations, data collections and results (Arbnor & Bjerke, 2009).

What also will matter are certain ultimate presumptions that each person carries around. The ultimate presumptions are based upon our own background hypothesis or normative theses, and will influence the way we look at problems and how we look at existing and available sets of techniques and at knowledge in general (Arbnor & Bjerke, 1997). For a method to be effective Arbnor and Bjerke (1997) therefore argued that it must be both *consistent*, meaning that it should be suitable for the problem under consideration and fit the ultimate presumptions, and *constructive*, in the sense that it also should fit each other. Thereby they saw methods as “*guiding principles for the creation of knowledge*” (Arbnor & Bjerke, 1997). Björklund and Paulsson (2014) also mentioned how people’s fundamental view of knowledge has an impact on the research goals and described the same three views as Arbnor and Bjerke (2009): *the analytical view*, *the systems view* and *the actors view*.

### 3.2 Methodological Views

With the purpose of the study in mind, to create a cost model showing a holistic view of the total cost of purchasing to improve sourcing and economic life cycle decisions, the researchers investigated what overall methodological view to obtain. The three different views are presented below, followed by the choice of methodological view and why it seems most suitable for this study.

#### 3.2.1 Analytical View

With an analytical view the goal is to explain the reality objectively and as completely as possible. The reality is assumed to be constructed as a whole, where the sum of the parts is equal to the whole. This mindset strives to find and explain casual relations, meaning cause-and-effect (Björklund & Paulsson, 2014). However, the causes are looked upon as independent of each other and of the observer. The prerequisites of the analytical view already exist theory and some given techniques to verify or falsify the stated hypotheses (Arbnor & Bjerke, 2009).

#### 3.2.2 Systems View

The systems view assumes, in contrast to the analytical approach, that the reality is arranged as a whole where the sum of the parts is separated from the whole. This implies that the different parts and the relationship between them are of great importance. With the systems view the investigator strives at explaining the reality objectively but with emphasize on explaining the connections and relations between various parts of a system. Finding the synergetic effects will be essential for the aim of understanding the underlying factors of different kind of behavior and thereby the whole picture of a system (Arbnor and Bjerke 2009; Björklund and Paulsson 2014).

### 3.2.3 Actors View

With the actors view the reality is not objectively, but seen as a social construction. This means that the reality is both affected by, and affects, the individual and also that it is not independent of its investigators. When the researchers are a part of the social construction the description of the reality will be influenced by their experience and actions (Arbnor and Bjerke 2009; Björklund and Paulsson 2014; Gammelgaard 2004).

### 3.2.4 The Overall View of this Research

This master thesis will be based upon a systems view. One reason is that the personnel at Duni have indicated that a problem is that they are only considering some parts of a product's total cost today. The cost drivers they use today will necessarily not give the whole and correct picture of the costs for an article. As mentioned in chapter one, Duni have realized they lack information about how sourcing decisions really affect the business as a whole. As it is today, the knowledge about their products' profitability is based on a limited number of aspects. To solve this problem, and provide a total cost of purchasing model to Duni, the systems view and its holistic approach seems appropriate. The research can, hence, try to make an objective investigation of a sourcing decision's impact on the different parts of the supply chain and how it affects the total. Also, from the researchers' perspective the systems view represents a methodological view suitable for the particular research area and the problem assumptions behind it. It is also in line with the researchers' fundamental view of knowledge, i.e. the ultimate presumptions we carry around. The systems view therefore seems to fit in with Arbnor and Bjerke's (1997) suggested requirements of being both consistent and constructive.

## 3.3 Research Approach

What also influence which form of study to be conducted in a research project is the size of the existing body of knowledge within the field. When there is little knowledge within the particular area *explorative* studies can be used. These are investigatory studies that are carried out to reach fundamental understanding of the subject. When a fundamental knowledge and understanding already exists within the field *descriptive* studies can be used. These studies are used when the aim is to describe the situation, but not explain relations within it. When the ambition, however, is to both describe and explain the area of research *explanatory* studies can be used. These studies aim for deeper knowledge about the area. Another form of studies that can be used when there already is some knowledge and understanding within a particular field are *normative* studies. These are used when the researcher both seeks to provide guidance and suggest measures (Björklund & Paulsson, 2014).

In addition to these four types of studies Kasanen et al (1993) introduced the constructive research approach as an option for a researcher. The approach has gained a lot of attention among business administration, engineering researcher and educational sciences, where it has been applied (Lukka, 2001). From the above mentioned studies, a normative study would probably be appropriate for the purpose of this research. Since the ambition is to provide Duni with guidance from a total cost of purchasing view and develop a tool for improving their sourcing decisions one could argue that normative studies would be suitable. But since the construction of the cost model will be a central part in the research, the constructive research approach has been chosen instead. The matrix, in Figure 7, illustrates the position of the constructive research approach as a methodology, clearly showing that it is normative, as well as empirical, by its nature.

	Theoretical	Empirical
Descriptive	Conceptual approach	Nomothetical approach Action-oriented approach
Normative	Decision-oriented approach	Constructive approach

Figure 7. The position of the constructive research approach as a methodology. (Kasanen, Lukka, & Siitonen, 1993)

### 3.3.1 The Constructive Research Approach

The constructive research approach is a research procedure developed to respond to the challenges constantly faced in management accounting from the real world. The approach aims at solving the problems through construction of organizational procedures or models. (Kasanen, Lukka, & Siitonen, 1993) This aligns well with the problem formulation and the purpose of this thesis. Duni are in need of a tool to improve their sourcing decisions and the aim is to construct it by developing a cost model. When developing a solution through constructive research approach there are some key elements to consider. In Figure 8 below, these key elements are illustrated as the four cornerstones of the constructive research approach (Lukka, 2001).

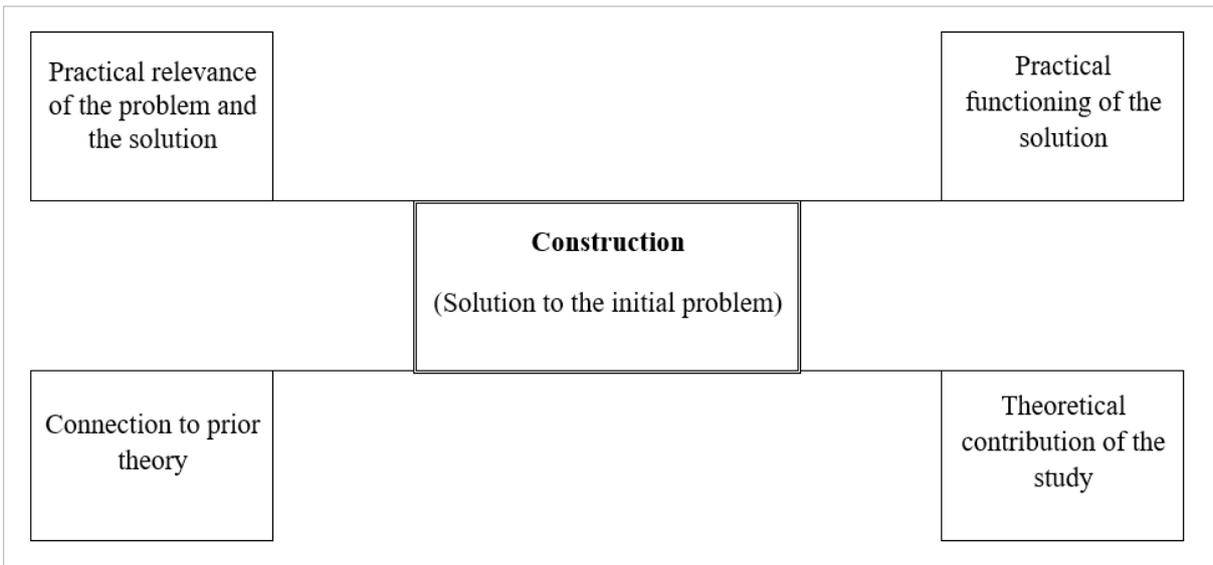


Figure 8. The key elements of the constructive research approach (Lukka, 2001).

Lukka (2001) further explained how these four cornerstones form the constructive research approach. One of the core features of the constructive research approach, according to Lukka, (2001), is the focus on real-world problem. In other words the problem, and its solution, should be practically relevant. It should also have research potential since another aim of the constructive research approach is to make a contribution to the theory within the research field. Lukka (2001) also stresses the importance on producing an innovative construction meant to solve the initial real-world problem.

To assess the solution and test the practical applicability, the constructive research approach requires an attempt for implementing the developed construction (Lukka, 2001). Kasanen et al (1993) argue that there is an essential connection between the usability of the construction and its scientific value. To try and reach applicability Lukka (2001) suggests a very close teamwork between the researcher and the practitioners. By involving and collaborate with the practitioners, new knowledge and learning should be gained on an experiential level. Lastly, the constructive research approach put emphasis on the linkage to already existing knowledge within the research field. Hence, it requires that attention is particularly put on reflecting the empirical findings back to theory (Lukka, 2001). To apply the constructive research approach on an actual research process Lukka (2001) provided some key steps to follow. The seven key steps to follow when using the constructive approach are presented in Figure 9 below.

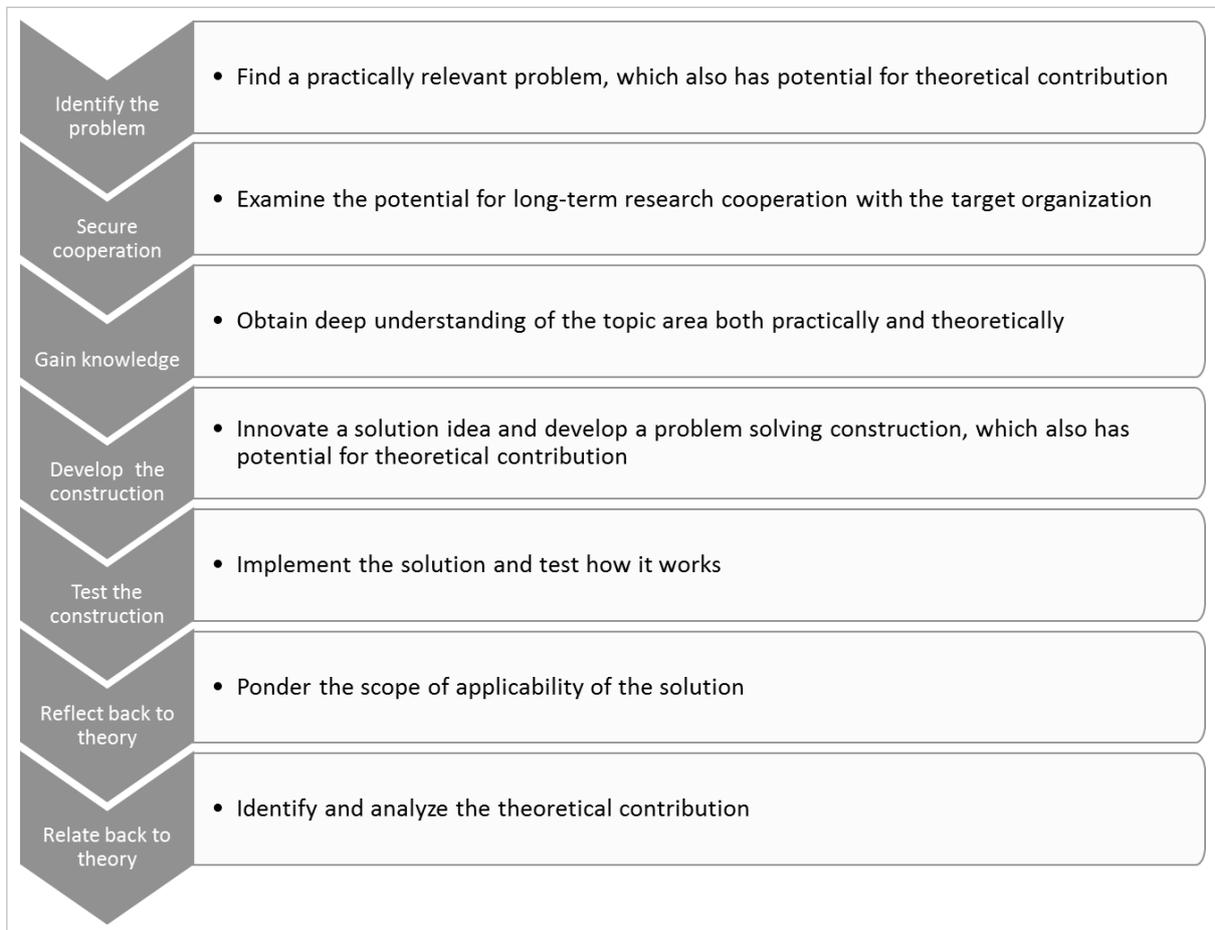


Figure 9. The key steps in the constructive research process

### 3.4 Data Collection Methods

Björklund and Paulsson (2014) described several different methods for data collection in a research. They explained the strengths and weaknesses of the different methods but were clear about how none of them were superior to another one. Instead they stressed the importance of choosing a data collection method that is appropriate and well-suited for the particular matter and situation. Therefore, it is not unusual that various data collection methods are used in the same research but for example in different phases of it (Björklund & Paulsson, 2014). The methods for gathering data in this research paper was a combination of presentations, literature studies and interviews, which according to Lukka (2001) is appropriate when obtaining a constructive research approach.

#### 3.4.1 Literature Studies

To set up the theoretical framework of this master thesis, literature studies were processed. The information obtained from literature studies is according to Björklund and Paulsson (2014) so called *secondary data*. Secondary data is facts that were produced with another purpose than the current research is aiming towards, but nevertheless information useful to gain knowledge about the study area. Literature studies can also provide the researcher with information about how much knowledge that actually exists within the field (Björklund & Paulsson, 2014). The literature studies in this research were done in some different steps<sup>6</sup> to try and reach as wide as possible in the beginning. The aim was to minimize the risk of missing any important literature. A wide range of literature, spreading over time, subject area and authors will (hopefully) result in better understanding and gaining knowledge about the research field. The ambition is that a thoroughly theoretical knowledge will improve the findings when analyzing the empirical data back with theory. This, in turn will have a great impact on the construction development. Moreover, a wide search of theory strives towards objectivity.

#### 3.4.2 Interviews

Interviews provide, contrary literature studies, *primary data*. Primary data means that the information is collected for the current research and thereby directly relevant for its purpose. Björklund and Paulsson (2014) described a variety of different kind of questionings that counts as a form of interview. The practical execution can for example vary in number of respondents, overall or at the same occasion, a form of group interview. The questioning can take place in direct contact with the interviewees, either on an eye to eye-contact or through telephone and similar. A questioning via email can also be considered an interview (Björklund & Paulsson, 2014).

What also differs among interviews is the structure that is undertaken. Björklund and Paulsson (2014) described three levels of structural organization of an interview. When the questions are both decided in advance and conducted in a certain order it is namely a *structured interview*. Another form of interview is where the subject areas and questions may be formulated subsequently as the questioning proceeds. This is called a *semi-structured interview*, and the interviewer can ask the questions based on the respondents previously answers, reactions or aspects on a matter. The third level of interview is the one were the questions only come up as the interview goes along, and resembles more like a conversation; thereby it is named an *unstructured interview* (Björklund & Paulsson, 2014). In this paper the latter form of interview, the unstructured one, is used in the initial phase of the study. Later on, during the empirical data collection phase of this research information was gathered through semi-structured interviews, to give necessary information needed for the analysis.

#### 3.4.3 Presentations

The information gained from presentations is often, like literature studies, secondary data. But just like literature studies it can give a large amount of information about a certain subject in an effective way (Björklund & Paulsson, 2014). Björklund and Paulsson (2014) stated that it was up to the researcher to reflect about what purpose the information have been proceeded for, and for whom it is addressed to. By

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<sup>6</sup> More information about the practical procedure of the literature studies can be found in section 3.5.3.2 *Literature Studies & Theoretical Development*.

being aware of the importance of a critical thinking, presentations can provide various forms of information and knowledge to the study (Björklund & Paulsson, 2014). Data collection through presentations was mainly used during the pre-study of this research and during the phase where the development of the construction took place.

### 3.5 Research Methods & Practical Approach

To work throughout the research with a constructive approach, the project was built upon the seven key steps provided by Lukka (2001). To manage the process and make sure that the purpose of the study would be fulfilled the phases were translated into this particular research process. The seven key steps of constructive research approach can be found in the arrow-boxes to the left in Figure 10 below. These phases are then further developed, to the right, to show the practical procedure of this study.

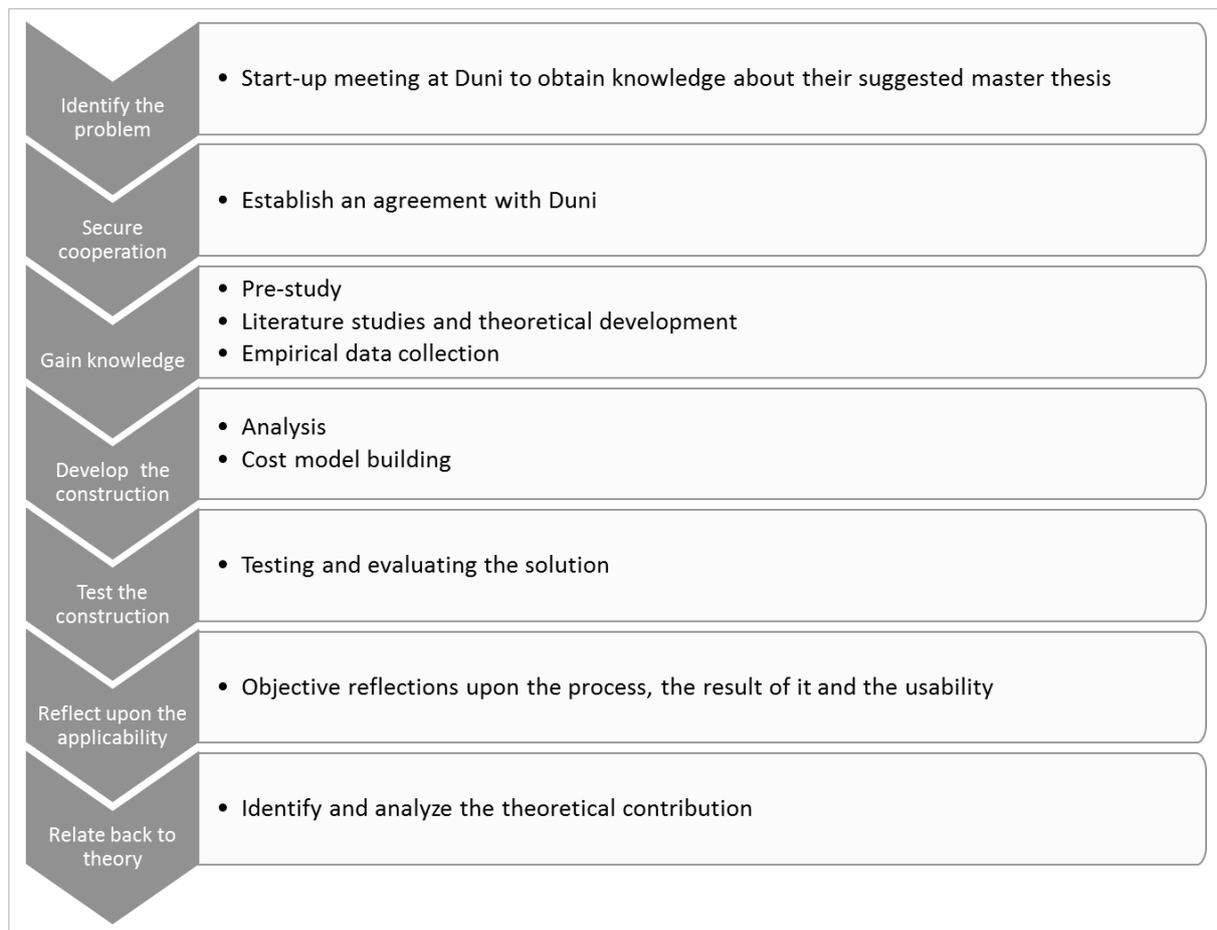


Figure 10. The constructive research approach through this master thesis project

#### 3.5.1 Identify the Problem

A start-up meeting was held at Duni to obtain information about the suggested master thesis topic. The suggested master thesis work from Duni was explained and the background information about how it arose at the company. The issue was found both practically relevant and with a potential for theoretical contribution, making this topic appropriate for a research (Lukka, 2001). However, Duni had from the beginning requested that the purpose of the master thesis was to do a total cost of ownership analysis and develop a tool that could be used for sourcing decisions. This was changed later on due to the fact that a total cost of ownership analysis should be based upon activity-based costing and therefore could be more time consuming than the time frame set within this master thesis project. Another reason was that the request of a total cost of ownership analysis was not grounded on any particular motives that precluded

the possibility of using an alternative cost models. The researchers could in that way start the project by assessing what cost model would fit best in with the identified problem and develop the model from those findings. The purpose of the study, thereby, became to create a cost model that Duni Meal Service can use in sourcing and economic life cycle decisions, showing a holistic view of the total cost of purchasing.

### 3.5.2 Secure Cooperation

A formal research agreement between the authors and the principal company, Duni, was conducted. The contract explained both parties' commitments and agreements about purpose, objectives, time frame and compensation. It also included agreements regarding data access and other necessities throughout the project. According to Lukka (2001) it would be convenient if the researchers were part of a team devoted to the study project. This is not truly the case for this master thesis since the research should be done only by the two authors of this paper. However, with the supervisor of the principal company close at hand and above all with the steering group closely involved in the project it is likely to fulfill the same purpose as with a project team.

### 3.5.3 Gain Knowledge

After the two steps in the start-up phase the next stage was to gain knowledge about the topic area. The aim was to obtain deep understanding both practically and theoretically, a step that differentiates the research study from typical consulting projects according to Lukka (2001). The theoretical knowledge gained in this phase provides a foundation for the continued work, both the empirical data collection but also the analysis part and further on the development of the construction. When obtaining deep understanding about the prior knowledge of the research field it also helps the researchers to analyze and identify the theoretical contribution of the study later on in the process (Lukka, 2001). The practical understanding is gained to get profound insights into the situation at the principal company, Duni, what the problems are and how they occur. The practical procedure of this phase is described below in the three different steps: *pre-study*, *literature studies and theoretical development* and lastly *empirical data collection*.

#### 3.5.3.1 Pre-study

The knowledge-gaining phase begun with combined data collection through unstructured interviews and presentations. Some presentations were held by the supervisor at the principal company, Duni, followed by unstructured interviews, both at the same occasion but also in separate meetings. These conversations gave a brief picture about the problems Duni is facing and therefore the purpose they had in mind for this master thesis. This was also to get to know Duni and their organization and therefore give information of which people in the company that should be involved in this research process.

Furthermore, it was also in this initial phase that the system description was developed to get an overview of how the studied system looked like. When having a systems view it was beneficial to actually have a visual description of the studied system. This made it easier for the authors to get a holistic view of the problem and also to better see how and where a suggested solution could be. Since the purpose of this study was to create a cost model that Duni Meal Service can use in sourcing and economic life cycle decisions this was already from the beginning perceived as the solution to some of the background issues. The purpose was also to show a holistic view of the total cost of purchasing at Meal Service and therefore it was important to get an overview of the whole studied system. Figure 11 describes the studied system, with the scope of this master thesis and also how a cost model could be the potential solution to some of the background issues at Duni.

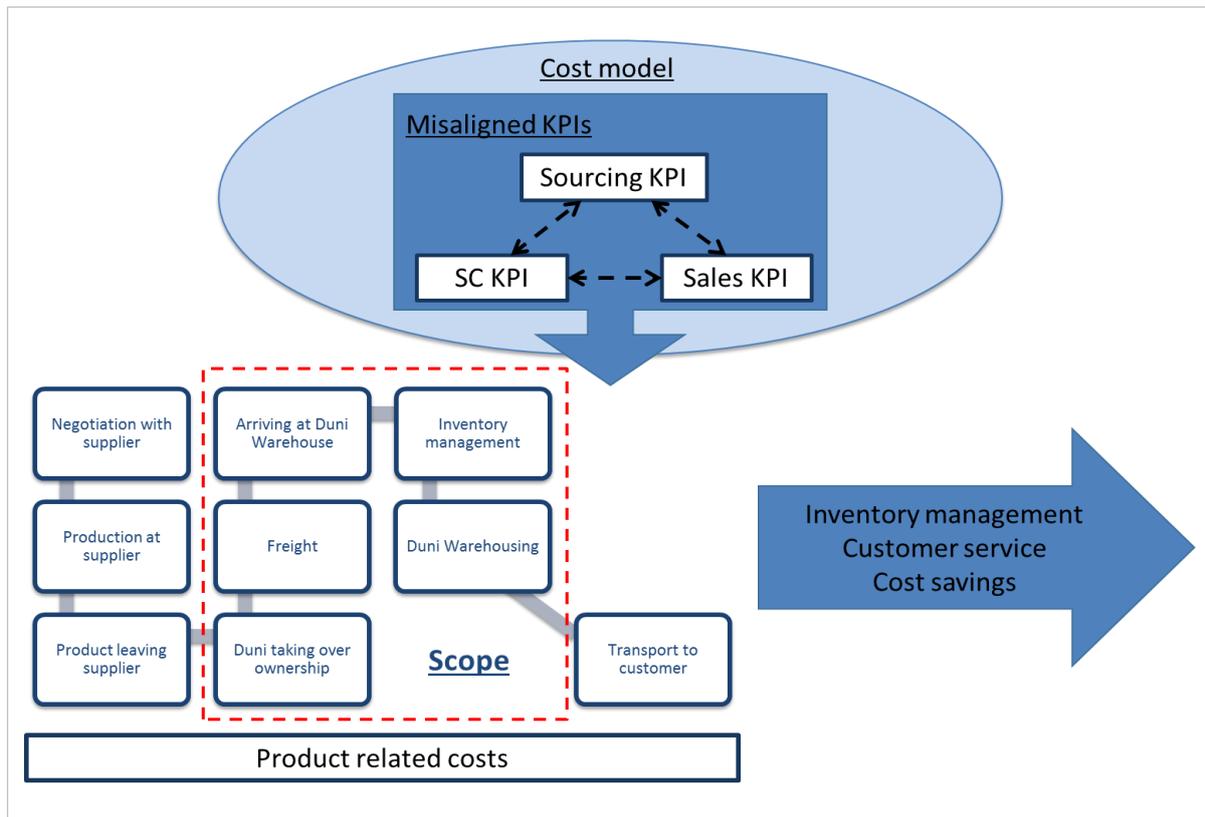


Figure 11. A description of the studied system.

### 3.5.3.2 Literature Studies & Theoretical Development

Since the principal company Duni, originally requested a TCO-analysis the searching was initiated around this subject, with search words such as *TCO* and *Total cost of ownership*. In combination with the recently conducted master thesis “The Development of a Purchasing Cost Model Facilitating Decision-making at Tetra Pak Packaging Solutions” (Bäckström & Magnusson, 2015) a list with potential search words was developed. In addition to TCO some other cost models were added to the list; *activity-based costing*, *landed cost* and *life cycle costing*. The list was also extended with subject terms aroused at the initial conversations with stakeholders at Duni. The subject terms are presented in a list in *Appendix 2*.

The actual searching took place in databases provided by LTH, particularly LUBsearch. The searching was focused on peer reviewed literature, but no limits were held on which type of literature to be found. This resulted in mostly articles from academic journals, but also some periodical articles, books and documents from websites. To narrow the searching around the topics interesting for this master thesis the subject terms was also combined in the searching. To even get a manageable search result all the cost models needed to be combined with terms such as *analysis*, *cost modeling*, *purchasing management* and *supply chain management*. The relevant findings from this firstly, wide, searching was summarized in an Excel data sheet. The continuing step of the literature study was to screen the findings to further investigate the relevance for this research.

This led to an iterative part of the literature study, where another searching took place. By going through the references of some of the relevant articles, new findings could be done. Furthermore, this gave an indication on what authors that was extensively and thoroughly researching this field and also who were cited most frequently. Therefore, additional searching on specific authors was done, which resulted in other articles written by the author, sometimes in cooperation with others, on similar research areas. The literature found through this additional search phase was also screened and relevant articles were added to the study.

The last step of the literature study was to scrutinize all articles found relevant more in-depth to decide what to actually use and what not to use in this research. Apart from the literature found in LUBsearch the authors decided to use van Weele's "Purchasing and supply chain management" (2014) as a reference to this study. The book had already been used by the researchers before and was found appropriate for this research area. The book is especially used as a reference to the more generally information about purchasing management, contextual aspects and cost management.

The studied system was a base when the theoretical development was to be conducted. The system itself, the identified problems and what was hypothetically going to be the solution of it were assessed when deciding on how to set up the synopsis of the theoretical framework. Furthermore the two sub-questions of this research were held in mind when the theoretical developments of different cost models were conducted. The aim was to investigate what the literature said about cost elements and cost drivers to include in a cost model, application of a cost model and success factors for implementing such a model.

### 3.5.3.3 Empirical Data Collection

The empirical data collection has been conducted through semi-structured interviews<sup>7</sup> within Duni. The same features as when the theoretical framework was developed were searched for in the empirical data collection phase. The interviews were based on these aspects to gain knowledge about what *cost elements* and *cost drivers* the different departments at Duni thought should be considered, as well as their opinions regarding *application* and *factors for a successful implementation* of a cost model. The interviews were also to further deepening the researchers knowledge about how the organization of Duni is built up, what is done within some of the different functions and how they are interacting with each other. The aim was to gather information from various parts of the organization and gain insight about the study area from different point of views.<sup>8</sup>

The first round of interviews was held at the Duni headquarter in Malmö and the second one at the production and warehouse plant in Bramsche, Germany. The interviewees<sup>9</sup> have been from the sourcing team within Meal Service but also category managers from the same department as well as the director of the department. Other participants have been working within the Production and Supply Chain department. Also the director of that department has been interviewed, as well as several business controllers. The choice of respondents is based upon the studied system. It was important for the researchers to gain knowledge about the whole system to get a holistic view. But it was also a matter of collecting information from the whole system, since there can be different perspectives on the same system.

The interviews have not been recorded but one of the authors has been functioning as a secretary whereas the other one have been acting mainly as the interviewer. The researchers have after each of the interview gone through the answers and assessed the information gathered. This in order to make sure that both of us shared the same opinion on what was said during the interview. In case of any misunderstandings or concerns about the collected data, the interviewees were contacted again to straighten out the question marks.

### 3.5.4 Develop the Construction

This phase of the study is according to Lukka (2001) a critical step. He mentioned that if a problem solving construction cannot be developed then there is no point in continuing with the project. It was therefore vital that the researchers were creative and managed to base the development both on the empirical and theoretical findings (Lukka, 2001). Before the actual model building could begin, the process was therefore initiated by analyzing the knowledge gained from the stage prior to this. The

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<sup>7</sup> The interview guide is to be found in *Appendix 3*.

<sup>8</sup> More detailed information about the approach for the empirical data collection can be found in section 5.1 *Interviews*.

<sup>9</sup> A list of all the interviewees can be found in *Appendix 4*.

empirical data was compared and analyzed with the theoretical framework in order to make findings and provide a foundation for the further study and development process.

Regarding the building of the model Lukka (2001) emphasized the distinction between developing an innovative construction and simply implement an already existing solution. The latter one should not be consider as an application of the constructive research approach (Lukka, 2001). Instead, it was important that the researchers put enough time into this phase and looked at it as an iterative process. A construction phase may start with developing initial prototype ideas, further on doing small-scale implementations and rework whenever needed along the process (Lukka, 2001).

#### 3.5.4.1 Analysis

To structure and process the collected information, an analysis was completed after the empirical data gathering had been done. The empirical data was analyzed on the basis of the theoretical framework. The findings from the interview study were compared with the findings in the theory, to seek for connections and gaps within the viewed system, and to understand how the different parts actually were affecting the sum of the whole.

The scope of the theoretical framework was built upon the description of the studied system. Furthermore the research questions gave a direction on how to develop the theoretical framework and thereby what to concentrate on in the literature. This was then further applied to the strategy of the empirical data collection. By doing this the analysis was being conducted through *pattern-matching* between the theoretical framework and the empirical data. The use of pattern-matching logic is described by Yin (1994) as one of the most desirable strategies for case study analysis. Even though this was not an analysis on a case study the authors found this analytical technique applicable and effective for the purpose of this analysis. The result of the pattern-matching was then used in the next step of the analysis phase, *workshop 1*. The workshop gave guidance to the researchers continuing analysis process and to the initiation of the model building.

##### 3.5.4.1.1 Pattern-matching

The purpose with the analysis was to seek for similarities between theory and the findings at Duni, but also to identify existing gaps. In accordance to this, Yin (1994) explained the pattern-matching logic as a technique where an empirically based pattern is compared with a predicted one. The predicted pattern is, hence, in this study the developed framework of theory. The similarities and gaps between the theoretical and empirical data were both regarding performance measurement at Duni and the data gathered more specifically for cost models and the implementation of it.

The researchers used both the theory and the empirical data to assess which the cost drivers are and which cost elements they actually drive. The findings regarding cost elements and drivers were then further assessed and visualized to better understand the nature of them. During this phase some quantitative data were collected. These were more specific cost information needed to further assess the identified cost elements and drivers. This data were gathered from the researcher's supervisor and the business controller, freight director and system developer at the logistics department, which all had participated in the interview study. The information was collected through conversations and mainly through material, such as pdf-files and excel-sheets, sent over e-mail. This data were assessed by the researchers in order to make a thoroughly estimation about the nature of the cost elements. These cost elements were then analyzed through a xy-diagram (Höst, Regnell, & Runesson, 2006) to obtain a better understanding of the impact on the cost elements and also the effect of them. With other words, the cost elements were assessed through an "affect-graph" to investigate which costs had a significant impact on the total cost but also to what extent the sourcing team at Meal Service were able to affect the different costs.

#### 3.5.4.1.2 Workshop 1

The result of the first part of the analysis was presented at a workshop with the steering group at Duni. The discussions that followed were to determine what cost elements and cost drivers to primarily include in the further development of the cost model. The aim of the workshop was also to decide upon some questions that gave the researcher further direction in the continued work process. These directions and the other result of the workshop were used for a final assessment on whether any of the cost models would be suitable for Duni's need or in other case how the specific cost model for Duni should be constructed.

#### 3.5.4.2 Model Building

The model building was started after the analysis part was done. The analysis provided guidance for how to initiate the model building and what aspects to consider. The decisions made in collaboration with the steering group at the first workshop and the findings from the analysis was of value when determining appropriate software and based on that, how to develop the cost model. Once again, some data collections were made throughout this phase. This was quantitative data such as additional cost information and knowledge about amounts of for example goods and pallets going inbound and outbound through Duni's warehouses. These data were collected through contact with the same people as mentioned before<sup>10</sup> and others responsible for information about a particular subject in matter. The business controller of the logistics department could for example provide a lot of information through files sent over e-mail and through Skype-meetings. Another example is the freight manager, who gave cost information about the inbound freight and other information regarding the inbound freight, customs and related procedures. All of the cost information that was asked for was rather easy to get a hold of. Instead, it was some of the information about amounts per year that was harder to receive. To make sure that the information gained was correct, the researchers always double checked with the source about where the figures came from, what it was based upon and when possible we tried to compare it with another similar information source. The first outline of the model was then presented and assessed in workshop number two.

#### 3.5.4.2.1 Workshop 2

This workshop was held together with parts of the steering group, during the model building phase. This was to assess the cost model in an early stage of the construction and to get help with ideas for how to allocate some of the costs in the model. The model building did then continue and an instruction guide for the cost model was developed.

#### 3.5.5 Test the Construction

After the construction development phase the next step was to test the innovated solution. This stage was undertaken in order to test the empirical feasibility of the construction. This is according to Lukka (2001) quite different from typical analytical model building where the constructions only are developed and seldom tested in practice. He also described how this phase is a proof for the "running" of the process because of the previously crucial step and how entering this step in a true manner is a very demanding task for all of the involved. The researchers needed to be very committed to the developed construction in order for a successful implementation of it (Lukka, 2001). It was therefore important to test the technical manner of the construction as well. To test the construction both a sensitivity analysis and some workshops were held, which are described in the following sections. Lukka (2001) pointed out how the innovated solution often had to be actively pitched to those involved in the organization. This should also be followed by education for the users, providence of an instruction manual and potential pilot tests, in order to make a successful implementation of the developed construction (Lukka, 2001).

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<sup>10</sup> The researcher's supervisor and the business controller, freight director and system developer at the logistics department

First of all the researchers tested the model on their own before presenting it to the users and the steering group. The researchers started the testing by going through the model in Excel, checking all of the programmed and connected cells. Together we controlled that the programmed calculations were correct and that all connections were right. To further evaluate that the model was correctly programmed some real life cases were requested from Duni to use in the model. The aim was to test the functionality of the model but also to make sensitivity analysis to make sure that the model was programmed correct and that the result was calculated in the right way.

#### 3.5.5.1 Sensitivity Analysis

In the sensitivity analysis, all of the input parameters were entered into the model. One by one they were then changed in order to control if the result changed in the expected way. The researchers discussed about what would happen if a certain input parameter was changed. When we were in agreement the parameter was both increased and decreased to control that the result changed in expected way. Next on, the input parameters were increased and decreased with a factor that made it possible to estimate with which amount the results would change. This was to deepen the first sensitivity analysis and more exactly control that the calculations behind the model were correct.<sup>11</sup>

#### 3.5.5.2 Workshops 3 & Workshop 4

The cost model was further tested through two workshops with different participants. Workshop 3 was once again held with the steering group to test both the validity and reliability of the cost model. This also gave the steering group an opportunity to assess and evaluate the cost model. Workshop 4 was similar to workshop 3 but the participants were the end-users of the cost model, at Duni. At the workshop the users got to learn about the model and they got training in how to use it. The aim of this workshop was also to test its usability and applicability and thereafter to be able to do some further developments. The participants in the both workshops played an important role for the improvements of the tool.<sup>12</sup>

#### 3.5.6 Reflect Upon the Applicability

The next step was done after the cost model was tested and evaluated. The researchers assessed the findings from the testing and evaluation of the construction to see what modifications that were needed to be done. Lukka (2001) pointed out an important thing during this phase, which was to pondering the scope of usability of the cost model. The researchers needed to objectively analyze the results of the whole project process. Lukka (2001) described it as to take a step back from the empirical work, and assess the learning process that the researchers has gone through during the project. If the previously stage, where the innovated construction were tested, went well and the purpose of the model were fulfilled, the researchers could discuss further applications of the construction in this phase. Lukka (2001) suggested that it would be interesting to see if the researchers believed that the solution would be suitable even for other organizations or what adjustments that would be needed on the construction in order to successfully implement it somewhere else.

#### 3.5.7 Relate Back to Theory

The last step of the constructive research approach is for the researchers to identify and analyze the theoretical contribution of the study (Lukka, 2001). Lukka (2001) described this phase as inevitable and crucial from the academic point of view. Therefore, it is also in this step essential that the researchers are able to take a step back and assess the project's theoretical contribution by reflecting the result and the findings back to prior theory (Lukka, 2001). In this thesis, the authors tried to achieve this by letting the project rest for a while and thus be able to distance from it before the final work was done.

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<sup>11</sup> The outcome of the sensitivity analysis is presented in section 7.3.1 *Sensitivity Analysis*.

<sup>12</sup> The outcome of the two workshops are presented in section 7.3.2 *Workshop 3 & 4*.

## 3.6 Credibility

Throughout the whole research process it is important to provide credibility to the study. Three aspects that can be seen as measures of credibility are validity, reliability and objectivity.

### 3.6.1 Validity

To actually measure what is intended to be measured is validity. If the researcher truly does that it minimizes the risk of methodological or systematic errors. The researcher should always strive for as high validity in the work as possible. One way of doing it is to use several different perspectives on the study object. This is called *triangulation* and is basically that two or more methods are used to investigate the object of the study, and thereby increase the validity (Björklund & Paulsson, 2014).

The cost model was validated based on the theory findings regarding success factors, when implementing and sustaining a cost model and also through the perspective of the employees at Duni. The steering group have helped validate the construction and the project itself along the way. Through regularly meetings they have provided us with insights and guidance to our work. This has helped us to avoid wrong assumptions and to increase the validity of the project. The decisions taken in agreement with the steering group have sometimes led to both changes and further developments. The final validation was executed in collaboration with both the steering group and the end-users at Duni, through workshops. They all received an educational guidance in how to use the model. Thereafter, they evaluated if the cost model truly works as it should as a support tool for sourcing decisions. The feedback we received on the workshops led to some final changes of the constructed model.

These were only final within this project and further developments should be done after this thesis. A second evaluation round after some months might show that the model needs to be updated to make the cost model fulfill its purpose even better. Some of the cost elements in the cost model are calculated based on average cost data and these need to be further assessed and updated to make sure that the model provides a picture of the holistic cost situation as correct as possible. One example is the inbound freight cost, which is calculated as an average cost for transportation within Europe or transportation from Asia to Europe. This means that the cost model cannot provide exact cost information about the inbound freight and might affect the application of using it when comparing two suppliers within the same continent.

### 3.6.2 Reliability

This is to what extent the measuring instruments actually are reliable. The operational reliability of the measuring instruments is affecting to what degree the investigation can be repeated and still provide the same values. To strive for a high reliability triangulation can once again be used. When using interviews having some control questions can increase the reliability (Björklund & Paulsson, 2014).

To strive for as high reliability as possible in the constructed cost model, the researchers have been in contact with a business controller during the development. The business controller has provided pure figures in form of cost data but also support for us to interpret the information correctly. The reliability was lastly tested simultaneously with the validation in workshop 3 and 4. When demonstrating how the cost model works, the steering group and the end-users were able to point out if any data or calculations seemed to be measured inaccurately. They also evaluated if the cost model itself seemed to give a reliable result. When using the model on some real life examples they also gave their opinion regarding the trustworthiness of the outcome of the cost model. Some changes had to be made to the model based on the feedback from these workshops. However, overall they seemed pleased with the construction itself as well as the outcome of the cost model. Further developments can be done to increase the reliability, both by including more cost elements into the model and also by collecting more cost data and adopting the calculations thereafter. This would make the model provide an even more correct picture of the cost situation. However, as a first edition, they were all satisfied with how the cost model turned out and the information provided by it.

### 3.6.3 Objectivity

Objectivity is explained as to what degree the values affect the research. To strive for as high objectivity as possible the content of a source should be provided in an unbiased way. There should not be factual errors and the researchers may not choose to present only the fact that goes hand in hand with their own opinion. The researchers should also try to avoid the use of loaded words to minimize objectivity issues to arise. Another way of increasing objectivity is to clarify and motivate the different steps and choices that were made throughout the study (Björklund & Paulsson, 2014).

The collaboration with the business controller also helped when discussing and analyzing estimations as objectively as possible. The business controller stated in an early stage that it was important for us to calculate with the true costs. She was also transparent and provided us with a lot of information to get the whole picture of the situation of today. We gained knowledge from different perspectives and learned about how the true costs looked like but also why this did not reflect how the costs were allocated in the different departments today. It was important for us to gain knowledge about the different perspectives, and why the decisions of today had been taken, in order to be as objective as possible.

### 3.7 Conclusion

In the last step of the research, the work was concluded and summarized with the results of the study. How the results affect the company and the consequences of that was also discussed. This opened up for suggestions to Duni on future work needed in the research area. For that matter there was also suggestions on future research opportunities, which are presented in section *8.3 Future Research & Development*.

## 4 Theoretical Framework

*Due to the extensive amount of information in the fourth chapter, this chapter starts with a detailed description of how the theoretical framework chapter is structured. This gives an overview of what theory that can be found in the chapter. Further on in the chapter some aspects of purchasing management will be explained, including cross-functional integration and contextual aspects. Next, detailed information about various purchasing cost models will be presented followed by some information regarding performance measurements.*

### 4.1 Overview of the Chapter

The theoretical framework chapter will be structured as shown in Figure 12. The chapter starts with purchasing management, such as supplier selection and how to measure purchasing performance. Then the chapter will continue with contextual aspects and the description of trade companies and how their work is structured. Furthermore follows a section about cost management introducing the work with cost models. After this four various cost models are defined with purpose to compare them and to get a good overview over the most common parameters used in different cost models. The findings from the presented cost models will then be discussed. The chapter continues with theory of measuring purchasing performance. Finally, the chapter is concluded by a synthesis of all the described theory.

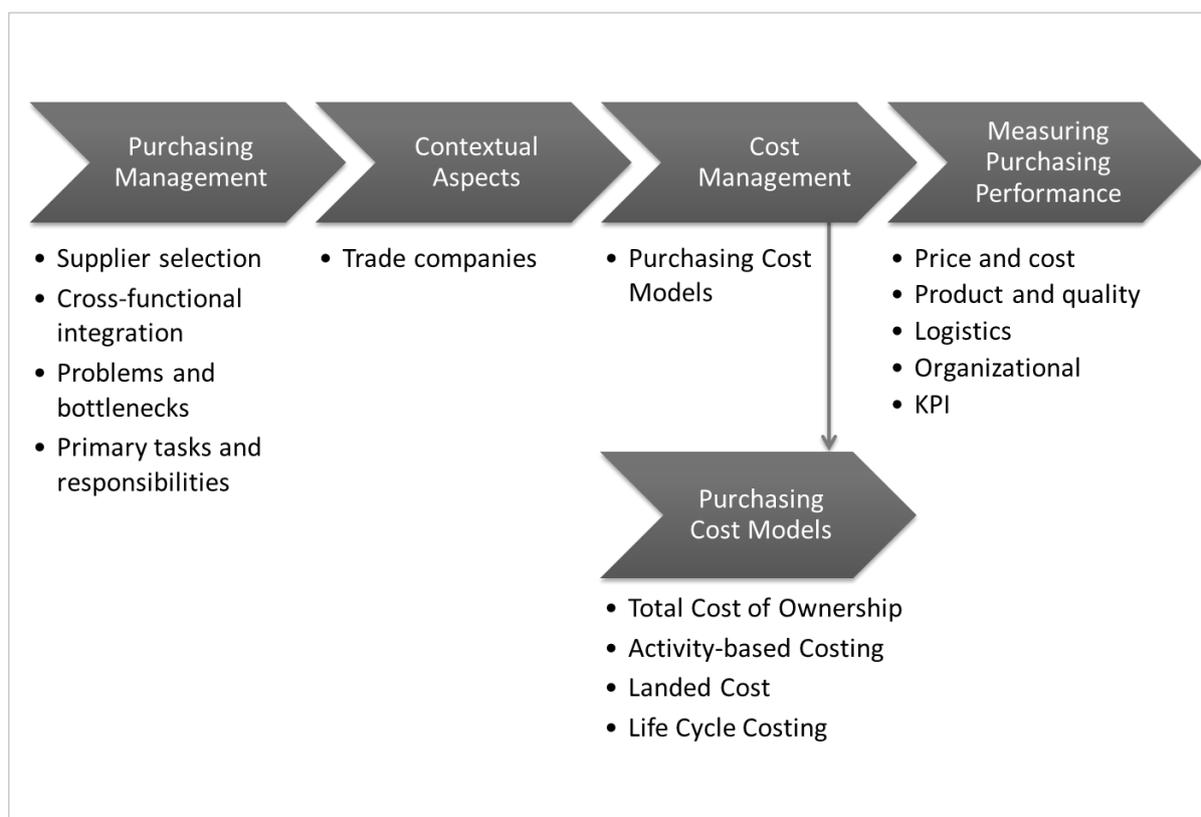


Figure 12 Content of the theoretical framework chapter

The cost models described in the section 4.4 *Cost Management* were chosen based on the frequency that they are mentioned in academic literature, shown in the literature review. These models should work as a benchmark in the analysis and further development of a cost model. To be able to compare them they will be described based on some pre-defined components. These components were chosen with our Research Questions in mind to get theoretical support on how to successfully develop and implement a suitable purchasing cost model at Duni. Therefore the following four components were chosen:

- Cost elements
- Cost drivers
- Application
- Success factors

The first two components are mainly connected to RQ1 whereas the last two are connected to RQ2.

## 4.2 Purchasing Management

Van Weele (2014) stated how important it is that the purchasing function works as more than only a service function within the organization. The buyers should by their activities make the company more cost aware and consistently seek for improvements of the price and value brought by the purchased goods. They should also constantly try to improve supplier performance by suggesting alternatives to existing product designs, materials or components to be used and challenge current suppliers. By doing this, the purchasing function should be recognized as a business driven activity rather than a service function and contribute to the company by reducing materials and supply-chain costs (van Weele, 2014).

### 4.2.1 Supplier Selection

One crucial part of the purchasing function is the supplier selection process. According to van Weele (2014) there are four important steps in the supplier selection process: firstly to determine the method of subcontracting, secondly to do a preliminary qualification of the suppliers, thirdly to prepare the request for quotation and analysis of the bids received, and finally to do the actual selection of the supplier.

In the final step, the purchasing department makes a preliminary technical and commercial evaluation, acknowledging all relevant aspects. Aspects that need to be weighted are technical, logistics, quality and financial and legal aspects. Of course, prices are compared as well. However, in the last step most buyers will look at a broader perspective: the total cost of ownership, which includes the total costs that the company will experience during the whole lifetime of the product (van Weele, 2014).

In order to make the selection process work as good as possible it is required from the organization to work with cross-functional orientation. Functions such as purchasing, quality, production and production planning need to be integrated to sufficiently manage the selection (van Weele, 2014).

### 4.2.2 Cross-functional Integration

It is very important that purchasing decisions not only aim at optimizing the purchasing performance, isolated from the rest of the organization. On the contrary the decisions should be made based on how they will affect other business activities as well, such as operations management, marketing and sales, logistics and transportation. Moreover the decisions should focus on optimizing the total cost of ownership and creating the maximum value for the purchasing spend, rather than only going for the lowest price possible (van Weele, 2014).

These kind of optimizing decisions are however very complex and hard to do. In order to do so it requires an integrated, cross-functional and team-based approach among all the affected business areas. Connected to this, the purchasing and supply strategies need to be developed closely together with all functions and with top management involvement (van Weele, 2014).

### 4.2.3 Problems and Bottlenecks

There is a lot to take into consideration when trying to create a successful purchasing process. Van Weele (2014) described a numerous of situations that potentially could obstruct the purchasing process. Some of the situations mentioned are: inadequate supplier selection, personal relationships with suppliers, lack of good contractual arrangements and poor administrative processes. Moreover van Weele (2014) discussed issues connected to delivery reliability, where problems as delays, non-completed deliveries, unsound packaging and quality issues might be consequences of unclear specifications or poorly selected suppliers. Furthermore it might be an issue if too much emphasis is put on price. In order to handle the purchase

effectively, the buying decisions need to be based on TCO models in which the initial purchase of a product is balanced against the life-cycle costs of the product (van Weele, 2014).

To prevent these problems, van Weele (2014) stresses the importance of having clear rules and guidelines and a professional administrative organization in place when it comes to the purchasing governance.

#### 4.2.4 Primary Tasks and Responsibility

In each purchasing function some core tasks and responsibilities need to be taken care of by the purchasing and supply managers in each organization. These tasks and responsibilities can, according to van Weele (2014) be summarized as: (1) operational excellence, (2) cost control, (3) risk management and (4) continuous improvement, and they will be described further as follows:

##### 4.2.4.1 *Operational Excellence*

Operational excellence is about securing timely and unobstructed availability of purchased goods, in both the short and long-term. The purchasing function needs to secure supply from reliable suppliers of a consistent quality and at a reasonable total cost, so that the purchased materials and services are available in line with the requirements of purchasing's internal customers. This means that effective and efficient supply is crucial in order for the purchasing function to keep its credibility in the organization (van Weele, 2014).

##### 4.2.4.2 *Cost Control*

This task and responsibility of the purchasing function is connected to spend-management: both when it comes to cost control and also reduction of all purchasing-related spends. When supply is secured, purchasing needs to make sure that the goods are supplied at the lowest total cost of ownership or best value (that the company can acquire against the money spent) (van Weele, 2014).

##### 4.2.4.3 *Risk Management*

Purchasing's risk management task is about to reduce the company's risk exposure in relation to its supply markets. This means that the company should avoid becoming too independent on few suppliers. It is important to have access to reliable suppliers since high quality and punctual delivery often are more important than price (van Weele, 2014).

##### 4.2.4.4 *Continuous Improvement*

In this task it is emphasized that suppliers often are a source of new products and production technologies, which could be utilized by having partnerships with suppliers in research and development projects. The purchasing function therefore has a development task in discovering these product and process innovations (van Weele, 2014).

### 4.3 Contextual Aspects for Trade Companies

Companies working with traded goods are characterized by the lack of own production processes connected to these goods. They might have some packaging activities or activities connected to splitting large bulk volumes into smaller batches but otherwise there are no transformations of the goods in the technical sense. This means that the value added within the organization is rather low compared with manufacturing companies. Instead the purpose of the trade function is to take care of the processes between the manufacturer and the final consumer. Therefore the buying function together with logistics, both inbound and outbound, are major activities within trade companies (van Weele, 2014).

As mentioned above trade companies fulfill the function of being intermediary between the producer and the end user. In his book, van Weele (2014) described some activities crucial for their value added within the trade company, activities that they are able to execute more efficiently than the manufacturers. Some of these activities are as follows:

Sales and promotion. By advertising and marketing, trade companies can reach many small customers at a relatively low cost and can create a brand image experienced as more positive, for the consumer, than the image of the producer itself.

Buying and building up a product assortment. By selecting product and building up an assortment based on the needs of a specific target group, trade companies make the market offer transparent and easier to access for the suppliers.

Bulk breaking. Trade companies can reduce costs for the producer and improve the accessibility of its products, by buying products in large quantities and then selling them in smaller units.

Storage. By keeping stocks, the trade company reduces costs for the manufacturer as well as the end user at the same time as they are having a high availability towards the end user.

Transportation. By taking over the transportation function from the producer the trade company often are able to work more efficient in this matter as a result of having a higher loading level.

Carrying the risk. They also take over some risks from the producers, such as risks of pilferage, damage and obsolescence.

Market information. By having an excellent picture of their target groups and sales opportunities, through advanced IT, trade companies can improve their relationship with the producers and help them to improve existing or develop new products.

(van Weele, 2014)

To conclude this section it is important to understand that being good at above-mentioned activities will help bring value-add into the trade organization. However, due to the wide variety of businesses within the trade sector and their differences in operations, it is according to van Weele (2014) impossible to generalize buying policies and an ideal structure of the buying organization.

## 4.4 Cost Management

In order to develop a purchasing function towards purchasing excellence, van Weele (2014) described some strategic management processes that need to be in place. One of these is the strategic cost management process including the identification of all costs, cost drivers and strategies with purpose to reduce or eliminate costs throughout the supply chain. This includes the development of cost models and value stream mapping to identify potential cost savings. Moreover, in the following section four various purchasing cost model concepts are described.

### 4.4.1 Total Cost of Ownership

#### 4.4.1.1 General

Ellram (1995) describes Total cost of ownership (TCO) as both a philosophy and a purchasing tool with the aim at understanding the true cost of buying a specific goods or service from a specific supplier. The true cost of purchasing is referred to as all costs that can be associated with the acquisition, possession, use and subsequent disposition of the purchase (Ellram, 1995). The TCO concept therefore strives at looking beyond just the purchase price and gaining knowledge about what other cost elements that can be found in relation to the purchased goods or services. These costs should be assessed whether or not they play an important or significant role during the whole time of ownership for the buying organization (Ellram, 1995). This cost analysis should be based on activities and Ellram (1995) describes TCO as a complex approach.

Furthermore Ellram and Siferd (1998) state the importance of TCO as a tool to support an organization's strategic cost management. In order to support, the TCO analysis used must be suitable for the corporate strategy of the organization. However depending on the strategic positioning of the organization the focus of TCO may vary within the organization's overall strategic cost management. Since TCO can be seen as a philosophy, Ellram and Siferd (1998) also explain that the TCO must fit the organizations philosophy and culture in order to be implemented.

#### 4.4.1.2 Cost Elements & Drivers

Alard, Bremen, Oehmen and Schneider (2010) defined a TCO model as an estimation of all direct and indirect costs that can be associated with a procurement object over its entire life cycle. Ellram and Siferd (1993) also added fixed versus variable costs as a way of describing costs incurred by an organization. They described how direct versus indirect costs or fixed versus variable costs are defined by how these costs change in relation to some activity over a given time period. Moreover, people are likely to understand that if an activity is performed a cost will incur in relation to that and therefore an activity-based costing is a relevant process to start with when doing a cost analysis (Ellram & Siferd, 1993).

Ellram and Siferd (1993) proposed some key purchasing activities related to the concept of TCO. These key purchasing activities are categorized into six major parts, as can be seen in Figure 13. Accordingly, the six categories each contain a number of activities that cause costs to incur.



Figure 13. Key purchasing activities contributing to the total cost of ownership. Simplified picture from Ellram and Siferd (1993, s. 166)

Ellram and Siferd (1993) divided activities needed in a purchasing cycle into *formal* activities and *support* activities. Formal activities are described as activities performed to get an entry to the formal purchasing or materials management system. The support activities on the other hand are performed to support and to be able to follow through the formal activities. The formal activities can also be the cause of the support activities to occur. Both the formal and support activities are typical activities performed by an organization along the purchasing process (Ellram & Siferd, 1993). Ellram and Siferd (1993) also proposed cost drivers that cause these activities to occur and thereby drive costs to incur along the purchasing cycle. The cost drivers can also be the parameters that drive the cost in different directions. A cost driver can either drive the cost sum to be higher or lower depending on the amount and time of resources needed for the activity to be accomplished (Ellram & Siferd, 1993). The possible cost drivers, according to Ellram and Siferd (1993), along a typical purchasing process are described below and also summed up in Figure 14.

In the beginning of the purchasing process, when a supplier selection is to be done, some of the cost drivers mentioned by Ellram and Siferd (1993) are the *complexity*, *uniqueness* and *price of the purchasing item and the required volume*. Other requirements that drive costs to incur are *legal and organization requirements*. Regarding the supply, the *familiarity and number of suppliers* are mentioned as well as the *location of the supplier* in relation to the purchasing organization (Ellram & Siferd, 1993). In the next stage when an order is

placed and later on an order confirmation is received, cost drivers such as *type of purchasing system* and *order complexity* was mentioned by Ellram and Siferd (1993). They also described cost drivers such as the *degree of cooperation between the purchasing organization and the supplier*, the *supplier's level of sophistication* and *type of purchasing contract*. Other things that drive activities to occur in this stage of the purchasing process are *forecast uncertainty* and *inability to manufacture the product as designed*.

When changes in the purchase order occur and needs to be handled, characteristics such as *complexity of the change* and *number of articles involved* are cost drivers. Also what *type of change* and what *impact it will have on customer orders and schedules* are cost drivers. The *supplier's unreliability* and *inability to forecast well* are also considered to be possible cost drivers at this stage (Ellram & Siferd, 1993).

When the order is to be received and entered into the inventory system of the purchasing organization the *reliability of both the supplier and the carrier* can be possible cost drivers. The *contracted delivery arrangements with the supplier* and the *agreed delivery date* can also drive costs to incur. The *agreement with the supplier* is also a cost driver when the payment for the order is to be done. At this stage in the purchasing process the *design of accounting system* and the *degree of internal control over payment authorizations* can also be cost drivers (Ellram & Siferd, 1993).

The last activity stages described by Ellram and Siferd (1993) is when the purchased item is used in the production and also when repair under warranty occur. The cost drivers here are likely to be the *design and complexity of the product* as well as both *supplier and product reliability*. The *strategy for both purchasing and production* are also possible cost drivers, as well as the *supplier approval process* (Ellram & Siferd, 1993).

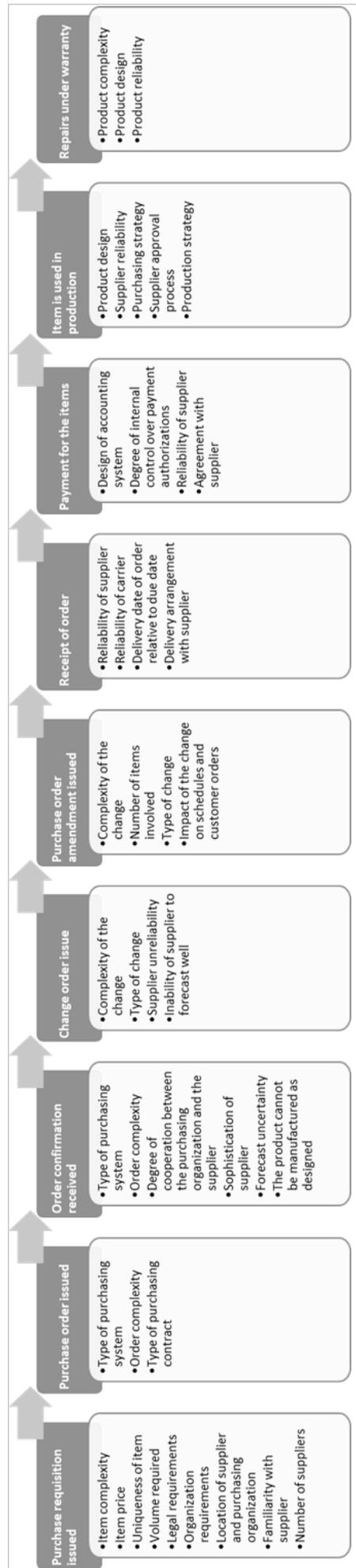


Figure 14. Possible cost drivers during a typical purchasing cycle. Rearranged picture from Eltham and Sijerd (1993).

Ferrin and Plank (2002) investigated the nature and use of total cost of ownership in different organizations. In their exploratory study, based on a survey with open-ended questions, they also made findings of a wide range of cost drivers that organizations base their TCO models on. The researchers categorized all the cost drivers into 13 main categories that will be presented in the text below and are summarized in Table 1 (Ferrin & Plank, 2002).

The first category is Operations Cost, which include cost drivers such as *manufacturing, capacity utilization, labor savings* and *line speed* (Ferrin & Plank, 2002). The next category is Quality, were cost drivers often are a consequence of poor quality. The cost drivers categorized under Quality are for example *durability, scrapping* and *quality improvement* (Ferrin & Plank, 2002).

Logistics is one of the categories were the largest number of cost drivers were categorized. These are cost drivers such as *freight, material handling, packaging, warehousing, tariffs* and *duties*, as well as *lead-time* and *on-time delivery*. The cost drivers in this category cover virtually all parts of the logistical process. In relation with Logistics a separate category, Inventory Cost, were created (Ferrin & Plank, 2002). The cost drivers in this category could be placed under Logistics as well but were seen as a separated group only focusing on factors driving inventory costs. These are *safety stock, storage, perishability, inventory turnover* and *design/procurement for inventory reduction* (Ferrin & Plank, 2002).

The cost drivers that can be found in the category Technological Advantage all include the impact technology could have on the buyer's cost structure. These are cost drivers such as *suitability for intended use, design obsolescence* and *long-term advantages*. Some of the cost drivers in this category are also referring to the suppliers' ability to manage technology changes, for example *supplier ability to change technology, flexibility for new use* and *changing technology* (Ferrin & Plank, 2002). This leads up to the category Supplier Reliability and Capability. In this category there are cost drivers like *trust, supplier capabilities* and *payment terms*, as well as *supplier ability to grow, service by supplier* and *stocking at supplier* (Ferrin & Plank, 2002).

Two of the categories with fewer cost drivers are called Customer-Related and Opportunity Cost. The first one, Customer-Related involves cost drivers that need to be measured from a customer's perspective. The cost drivers belonging to this category is *user satisfaction, customer perceptions* and *customer specifications*. These cost drivers implies the organizations' view of the importance of a customer-focused strategy. The two cost drivers *cost of money* and *overhead* are categorized as Opportunity Cost (Ferrin & Plank, 2002). Ferrin and Plank (2002) assumed that overhead was mentioned as a cost driver because of the impact the increasing overhead can have on the resource capability for other activities.

Another smaller category is Initial price. In this category the four cost drivers *unit cost, initial purchase price, long-term price stability* and *initial capital expenditure*, can be found (Ferrin & Plank, 2002). Ferrin and Plank (2002) suggest that long-term price stability should be interpreted as the ability for a supplier to keep the initial price over a longer period of time.

For the cost drivers associated with the preserving of the assets for operation Ferrin and Plank (2002) categorized them under Maintenance. The Maintenance cost drivers are for example *supplies, downtime, repair costs, spare parts* and *repair frequency*. Another category is Transaction Cost including cost drivers as *administration of post-purchase agreement, ease of transaction, cost to change supplier* and *procurement*. These are all cost drivers incurring costs during the actual procurement (Ferrin & Plank, 2002).

The category Life Cycle, on the other hand, includes cost drivers related to cost over time, sometimes even related to a product's whole life cycle. In this category cost drivers such as *long-term usage, life of product, cost savings over life of product* and *life cycle obsolescence cost* are found (Ferrin & Plank, 2002). The Life Cycle costs imply taking the long-term perspective into consideration in supply management, and a lot of the respondents of Ferrin and Plank's (2002) survey said they used life cycle costing procedure to compute cost over time.

Besides all of the cost drivers categorized into one of the above-mentioned categories, Ferrin and Plank (2002) categorized a lot of cost drivers under Miscellaneous. These were cost drivers that they did not consider fitting under any of the other cost driver categories. Some examples are *disposal costs*, *indirect labor*, *currency exchange rates* and *environmental issues* (Ferrin & Plank, 2002).

Cost Elements	Cost Drivers
Operations Cost	<ul style="list-style-type: none"> <li>• Manufacturing</li> <li>• Capacity utilization</li> <li>• Labor savings</li> <li>• Line speed</li> </ul>
Quality	<ul style="list-style-type: none"> <li>• Durability</li> <li>• Scrapping</li> <li>• Quality improvement</li> </ul>
Logistics	<ul style="list-style-type: none"> <li>• Freight</li> <li>• Material handling</li> <li>• Packaging</li> <li>• Warehousing</li> <li>• Tariffs</li> <li>• Duties</li> <li>• Lead-time</li> <li>• On-time delivery</li> </ul>
Inventory Cost	<ul style="list-style-type: none"> <li>• Safety stock</li> <li>• Storage</li> <li>• Perishability</li> <li>• Inventory turnover</li> <li>• Design/procurement for inventory reduction</li> </ul>
Technological Advantage	<ul style="list-style-type: none"> <li>• Suitability for intended use</li> <li>• Design obsolescence</li> <li>• Long-term advantages</li> <li>• Supplier ability to change technology</li> <li>• Flexibility for new use</li> <li>• Changing technology</li> </ul>
Supplier Reliability and Capability	<ul style="list-style-type: none"> <li>• Trust</li> <li>• Supplier capabilities</li> <li>• Payment terms</li> <li>• Supplier ability to grow</li> <li>• Service by supplier</li> <li>• Stocking at supplier</li> </ul>
Customer-Related	<ul style="list-style-type: none"> <li>• User satisfaction</li> <li>• Customer perceptions</li> <li>• Customer specifications</li> </ul>
Opportunity Cost	<ul style="list-style-type: none"> <li>• Cost of money</li> <li>• Overhead</li> </ul>
Initial price	<ul style="list-style-type: none"> <li>• Unit cost</li> <li>• Initial purchase price</li> <li>• Long-term price stability</li> <li>• Initial capital expenditure</li> </ul>
Maintenance	<ul style="list-style-type: none"> <li>• Supplies</li> <li>• Downtime</li> <li>• Repair costs</li> <li>• Spare parts</li> <li>• Repair frequency</li> </ul>

Transaction Cost	<ul style="list-style-type: none"> <li>• Administration of post-purchase agreement</li> <li>• Ease of transaction</li> <li>• Cost to change supplier</li> <li>• Procurement</li> </ul>
Life Cycle	<ul style="list-style-type: none"> <li>• Long-term usage</li> <li>• Life of product</li> <li>• Cost savings over life of product</li> <li>• Life cycle obsolescence cost</li> </ul>
Miscellaneous	<ul style="list-style-type: none"> <li>• Disposal costs</li> <li>• Indirect labor</li> <li>• Currency exchange rates</li> <li>• Environmental issues</li> </ul>

Table 1. Cost drivers found by Ferrin and Plank (2002) and categorized into 13 different groups.

#### 4.4.1.3 Application

The reasons for using TCO in an organization may vary, and Ellram (1994) made several findings in her case study research. The study included nine firms with different approaches, models and aims with their use of TCO. One of the first applications mentioned is to support supplier selection. Decision-making regarding Request for Proposal, Quotation or Bid can then be based upon TCO data. The data can also be of use in a negotiation situation or to measure ongoing supplier performance. Further on it can then be useful to identify priorities and develop supplier improvements. Another reason for using total cost of ownership is for benchmarking, by comparing different suppliers' performance against each other or even a supplier themselves over a time period. Thus, the TCO may also be of help for decisions regarding the supply base, such as reduction of it or volume allocation (Ellram, 1994).

##### 4.4.1.3.1 Summary of Application

- Support supplier selection for Request for Proposal, Quotation or Bid
- Provide data for negotiations
- Measure ongoing supplier performance
- Identify priorities
- Develop supplier improvements
- Benchmarking by comparing suppliers' performance
- Support supply base decisions

#### 4.4.1.4 Success Factors

As mentioned earlier in the text Ferrin and Plank (2002) have categorized a lot of identified cost drivers as Miscellaneous cost drivers. They believed that this would imply that some cost drivers are only considered relevant for specific situations. Meaning that a TCO analysis should consider identifying unique cost drivers for a particular product that may not be as relevant for another product (Ferrin & Plank, 2002).

This, together with answers from their survey, made Ferrin and Plank (2002) suggest the need for multiple models when assessing the total cost of ownership for a variety of commodities. Moreover, they said that even though some cost drivers are more general and probably will be used in many TCO models their findings indicate that there does not exist a standard TCO model (Ferrin & Plank, 2002). This is opposite from what Ellram (1994) wrote in her case study research. She made a difference between the use of standard and unique TCO models, and discussed how the choice of model was highly important. However, she did also mention them as relatively standardized and relatively unique TCO models, describing how a standardized model could require some modification as well as how a unique model could be based upon the same methods used for a standard model. Ellram (1994) emphasized the nature of a product as an important aspect for the purchasing department to consider when developing a TCO model suitable for that product. She also concluded that there is no standard approach ensuring the use and implementation of TCO to be successful (Ellram, 1994).

#### 4.4.1.4.1 Summary of Success Factors

- Consider the choice of standard or unique model
- Base the model development on the nature of the product and the specific situation
- Identify unique cost drivers
- Use multiple models when analyzing multiple products

#### 4.4.2 Activity-based Costing

##### 4.4.2.1 General

Cooper and Kaplan (1988) presented an alternative approach to the typical cost accounting systems and referred to it as activity-based costing. The reason for an alternative approach is the shortcomings they recognized in the cost accounting systems used by companies at that time. The authors identified the problem as a lack of development regarding product cost information in relation to the progress of new production technologies and the growth of marketing channels. With distorted cost information but increased product lines and intensified global competition the organizations tend to take ineffectively decisions affecting the competitiveness and profitability of the whole business (Cooper & Kaplan, 1988).

Activity-based costing (ABC) is a costing method using just activities to allocate costs to products or services provided by an organization. The method is to firstly identify all activities that are being executed in an organization and then assign the costs of the resources needed for these activities to all the goods or services. The aim of this is to give the firm a more exact number of what the true cost for each product is. With the true cost available, the organization can then use it as a foundation for several decisions regarding the particular product. Activity-based costing can especially be used to gain knowledge about product and customer cost and thus profitability of a certain product (van Weele, 2014).

##### 4.4.2.2 Cost Elements & Drivers

Cooper and Kaplan (1988) defined activity-based costing both as a tool of corporate strategy and a formal accounting system. Since practically all activities within a company is completed to support the production and delivery of goods or services to customers, they can be considered as product costs. Cooper and Kaplan (1988) then stated that most of the support costs are divisible and separable and the company should therefore be able to allocate them to individual goods or product families. With the activities considered as product costs themselves, the cost elements and cost drivers might be considered as the same. Cooper and Kaplan (1988) argued that with the theory behind ABC the cost for a product or a product family therefore included the following categories.

- Logistics
- Production
- Marketing and sales
- Distribution
- Service
- Technology
- Financial Administration
- Information Resources
- General Administration

(Cooper & Kaplan, 1988)

##### 4.4.2.3 Application

Turney (1989) described activity-based costing, like others, as a technology for linking costs to a certain product depending on what activities have been performed to produce and distribute it. The result of an ABC model thus provides accurate information about the true costs. With the right cost information an organization is able to focusing manufacturing strategy, designing products to increase customer value, and continuously improving operating activities within (Turney, 1989). According to Turney (1989), an organization's manufacturing excellence is depending on the continuous improvement of these three

areas. He means that a properly designed ABC increases the chance of success in these broad types of activities, which is a requirement for manufacturing excellence (Turney, 1989). As already mentioned, van Weele (2014) described how the true cost information gained from ABC can be used to better understand product and customer cost and thus the profitability of a certain product.

However, Innes and Mitchell (1995) expressed how the use of activity-based costing had extended to a wide range of cost management applications. For example, they saw a potential usage of ABC to support the product or service pricing, and to gain cost reduction possibilities due to the transparency it brings forward. Moreover, the ABC is a good foundation when taking decisions upon matters like product range as well as output and component subcontracting (Innes & Mitchell, 1995). They also suggested that the cost information gained from an ABC could be seen as performance measurements. Activity costs, for example, gives an indication of what resource input is needed. They also argued that cost driver volumes and cost driver rates could be looked upon as a set of performance measures, since they provide information about work throughput levels and efficiency (Innes & Mitchell, 1995). Lastly, Innes and Mitchell (1995) proposed the ABC approach for cost modeling. Compared to the traditionally used cost models, where costs, as already mentioned, are categorized only as fixed or variable, ABC gives a more realistic view to cost analysis for modeling (1995).

An additional usage area is suggested by Roodhooft and Konings (1997). They proposed the usage of ABC to assess an organization's relationship with its supplier and thereby improve the vendor selection and evaluation process. This, because of the cost information a company gain through ABC. Roodhooft and Konings (1997) argued that the systematic approach undertaken when computing the costs through ABC improves the objectivity. Therefore, when looking at the total cost brought upon the organization by a supplier, the company gets a more unbiased picture of a vendor's performance.

#### 4.4.2.3.1 Summary of Application

- Provide information about the true costs
- Focus manufacturing strategy
- Design products to increase customer value
- Improve operating activities
- Reach manufacturing excellence
- Profitability of a certain product
- Product or service pricing
- Cost reductions
- Support product range, output and component subcontracting decisions
- Foundation for performance measurements
- Cost modeling
- Supplier selection
- Supplier evaluation

#### 4.4.2.4 Success Factors

Cooper and Kaplan (1988) suggested that the process of designing and implementing activity-based costing should begin with interviews. The interviews should be held with the managers of the relevant departments within an organization to get the required information. First of all the focus should be on collecting data on direct labor and materials cost. The next step is to gather information about indirect resources and how these can be associated with the needs from particular products. To do this properly and get the accurate data needed, Cooper and Kaplan (1988) provided a guideline with three rules to follow in this process. The first rule is that the focus should be on expensive resources. In this way the organization make sure to include those activities where the potentially biggest cost savings are to be found. Secondly, they suggested to look for diversity and emphasize those resources where the utilization of them is strongly related the product type. The third rule is to focus on resources with a demand pattern different from traditional allocation measures, such as direct labor or processing time. The last two rules

aim at finding the resources generally measured inappropriate with the traditional cost systems (Cooper & Kaplan, 1988).

The subsequent procedure after the data-gathering phase is to analyze how costs can be traced from resources to activities and then from activities to specific products. When quantifying the costs and address them to specific products Cooper and Kaplan (1988) stresses the difficulties of doing it precisely correct with the exact value of the costs. Instead they emphasize on striving to be basically correct than being precisely wrong. In activity based costing it is good enough to be within 5 or 10 % of the actual demand a product have on the resources of the organization (Cooper & Kaplan, 1988).

#### 4.4.2.4.1 Summary of Success Factors

- Gather information by interviewing department managers
- Collect the required data in a prioritized order
- Start with direct labor and materials cost and then indirect resources
- Focus on expensive resources and resources traditionally measured inappropriate
- Basically correct is good enough

### 4.4.3 Landed Cost

#### 4.4.3.1 General

The approach with landed cost is to only assess those costs related to sourcing items and also the costs for bringing them to the costumer (Young, Swan, Thomchick, & Ruamsook, 2009). To better explain it Young et al. (2009) compared landed cost to total cost of ownership where cost activities are to be identified in the whole period of an asset's ownership by an organization. Furthermore they referred to Ellram's (1993) segmentation of when the different cost drivers occur. She divided the ownership into pre-transaction, transaction and post-transaction phase. These three phases made sure that the whole time period was taken into consideration. Thus, all of the activities driving costs throughout a products entire ownership period were to be assessed. In comparison to that Young et al. (2009) put landed cost within the transactional phase.

#### 4.4.3.2 Cost Elements & Drivers

Young et al. (2009) recommended that in order to take effective sourcing decisions the organization needs to assess a lot of cost aspects along in the supply chain. The assessment should not only be comprehensive but also systematically performed to gain enough support into the cost model. However, in the result of their study, they provided a multi-module model saying it could be developed to further expand the concept of landed cost. The multi-module model is based on the findings of their case study of six companies. The study was limited to consider only imports into the USA and thereby explains some of the specific variables in the model. The multi-module model including a landed cost model in the first five modules are presented in Figure 15 (Young et al., 2009).

Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
<input type="checkbox"/> Price	<input type="checkbox"/> Transport	<input type="checkbox"/> Customs	<input type="checkbox"/> Inventory	<input type="checkbox"/> Overhead	<input type="checkbox"/> Risk
<input type="checkbox"/> Supplier price	<input type="checkbox"/> Foreign inland	<input type="checkbox"/> Tariff rate	<input type="checkbox"/> Cycle stock	<input type="checkbox"/> Sourcing	<input type="checkbox"/> Compliance
<input type="checkbox"/> Selling terms	<input type="checkbox"/> Line haul	<input type="checkbox"/> Merchandise processing fee	<input type="checkbox"/> Safety stock	<input type="checkbox"/> Due diligence	<input type="checkbox"/> Reputation
<input type="checkbox"/> Payment	<input type="checkbox"/> US inland	<input type="checkbox"/> Harbor maintenance fee	<input type="checkbox"/> Inventory in transit	<input type="checkbox"/> Compliance	<input type="checkbox"/> Health
<input type="checkbox"/> Payment process cost	<input type="checkbox"/> Accessorials			<input type="checkbox"/> Relationship	<input type="checkbox"/> Safety
	<input type="checkbox"/> Insurance			<input type="checkbox"/> Learning curve and supplier development	<input type="checkbox"/> Environment
	<input type="checkbox"/> Packaging			<input type="checkbox"/> Duty management	<input type="checkbox"/> Legal liability

Figure 15. A multi-module model for landed cost, slightly adopted from Young et al. (2009)

Feller (2008) stressed the importance of the four primary sources of costs, as he called them. This was *material cost, transportation cost, inventory carrying cost* and *trade compliance costs*, not totally different from what Young et al. (2009) suggested. In the landed cost model developed by Feller (2008), he considered all these cost components as well as other costs that he thought might have impact on what sourcing decision to take. He tried to make it as comprehensive as possible but emphasized on including those costs that contributed the most significant portion of cost.

#### 4.4.3.3 Application

Each of these six modules provided by Young et al. (2009) consists of a number of variables that were identified as necessary to support offshore sourcing decisions effectively. However Young et al. (2009) made findings about how the use of module 4 through 6, mentioned above, were far less common than the use of the others. It seems like companies tend to only use transaction price, transportation costs and customs duty information when taking sourcing decisions (Young et al., 2009).

The findings regarding the use of landed cost models in organizations showed that comprehensive landed cost models are not applied to any significant extent as a tool to support effective sourcing decisions (Young et al., 2009). The landed cost models that are used are instead limited in content. They often lack information such as costs for increased cycle inventory and safety stock levels, but also costs for ownership of goods in transit. Another element that is rarely found in the landed cost models used by organizations is administrative overhead cost (Young et al., 2009).

Feller (2008) also mentioned how initial landed cost models were restricted and only considered material and transportation costs. As already mentioned he developed a landed cost model including several more cost components that he found relevant. He stressed the importance of being able to consider the trade-offs between these costs. If a model could provide that trade-off analysis Feller (2008) believed it to be useful for strategic supplier selection decisions, where the aim does not have to be minimizing the total landed cost but to consider risks and other business factors' impact. He suggested that the landed cost model could standardize the supplier selection process and he also saw the model as a tool for supplier evaluation. Furthermore the landed cost model provided a more complete and holistic perspective of the cost and risk situation and thereby highlighted potential cost savings (Feller, 2008). In a total Feller (2008) described the landed cost model as a decision making tool that would increase cross-functional work and facilitate global sourcing decisions.

##### 4.4.3.3.1 Summary of Application

- Support and facilitate sourcing decisions
- Increase cross-functional work
- Strategic supplier selection decisions
- Standardize the supplier selection process
- Supplier evaluation
- Provide complete cost and risk information
- Cost savings

#### 4.4.3.4 Success Factors

Young et al. (2009) stated that one of the key factors for the uncommon use of full-scale landed cost models was the lack of data in the organization. Necessary information that was not easily accessible was simply left out from the cost model. The reason for overlooking these data seemed to be related to the time aspect. Because from their study Young et al. (2009) could see that organizations often had a limited time frame when carrying out the cost analysis, affecting that the data collection was made properly. The last factor for the lack of comprehensive landed cost models was identified as the organizational structure (Young et al., 2009). Young et al. (2009) mentioned that the structure itself might be inhibiting the use of these models, and sometimes even totally preclude them.

To prevent a shortened time frame from affecting the extension of the landed cost model the information needed should be gathered continuously. Another reason for that are the consistent changes that occur in today's global businesses. These changes will affect the considered data. It is therefore important that an organization see the data gathering as an iterative activity. If the dynamic nature of global business is being captured, it builds in a higher reliability into the cost model, and its use for offshore sourcing decisions (Young et al., 2009).

#### 4.4.3.4.1 Summary of Success Factors

- Allow sufficient time frame for a cost analysis
- Organizational structure
- Gather information continuously
- Consider data collection as an iterative activity

#### 4.4.4 Life Cycle Costing

##### 4.4.4.1 General

Life Cycle Costing (LCC) is a part of Life Cycle Management (LCM) according to Hunkeler and Rebitzer (2003). They described how LCC is a concept within the LCM toolbox that links together the environmental concerns with the core business strategies. This is according to Hunkeler and Rebitzer an important connection since environmental considerations often are seen as an obstacle to business development. The concept of LCC is instead to incorporate environmental management into the total business management and thereby involve it into manufacturing and sales planning. LCC is similar to total cost of ownership seen as a method going beyond the traditional concepts of cost management, in the sense that it take other than the typically cost issues into consideration (Hunkeler & Rebitzer, 2003). Woodward (1997) described life cycle costing as a method to optimize the value for money in the ownership of physical assets. The aim is thus to minimize the life cycle cost of an asset. The approach for doing it is to optimize the trade-off between all of the costs estimated to incur by the asset during its entire life (Woodward, 1997).

##### 4.4.4.2 Cost Elements & Drivers

Woodward (1997) described that all the cash flows connected to an asset during its life cycle needs to be considered in LCC. This implies all costs that incur from the acquisition of the item to the disposal of it. However Woodward (1997) mentioned different ways of categorizing the cost components, which are shown in Table 2. Other researchers made these categorizations, but they have an influence on the cost structure set up. The cost structure will in turn have an impact on the measuring of the cost components and the allocation of costs. The grouping of cost elements will therefore affect the result of the LCC. To start with Woodward (1997) is citing White and Osvald (1976) in their categorization into *engineering and development, production and implementation, and operation*. Another categorization is cited from Callick (1978) who divided the elements into the three groups *cost of use, cost of ownership and cost of administration*. Another categorizing is found in Kaufman's (1970) eight-step approach to LCC, also provided by Woodward (1997). This segmentation is further developed and consists of *initial acquisition costs, operating costs, maintenance costs, overhaul costs and initial spares cost*.

Different ways to categorize cost elements in Life Cycle Costing		
<ul style="list-style-type: none"> <li>• Engineering and development cost</li> <li>• Production and implementation cost</li> <li>• Operating cost</li> </ul>	<ul style="list-style-type: none"> <li>• Cost of use</li> <li>• Cost of ownership</li> <li>• Cost of administration.</li> </ul>	<ul style="list-style-type: none"> <li>• Initial acquisition cost</li> <li>• Operating cost</li> <li>• Maintenance cost</li> <li>• Overhaul cost</li> <li>• Initial spares cost</li> </ul>

Table 2. Categorization of cost elements in Life Cycle Costing according to respectively White and Osvald (1976), Callick (1978) and Kaufman (1970), and cited by Woodward (1997).

#### 4.4.4.3 Application

Norris (2001) described how life cycle costing is used to compare and determine the cost-effectiveness of alternative investments, but also mentioned that it can be used for other business decisions. Regardless what, it should be done from the perspective of an economic decision maker such as a manufacturing firm or a consumer. With life cycle costing as a part of life cycle management Hunkeler and Rebitzer (2003) said that they believed it to be applicability for new product development, product introduction, supply chain negotiation, environmental product declarations and cost reduction.

##### 4.4.4.3.1 Summary of Application

- Compare and determine the cost-effectiveness of alternative investments
- Support economic decision makers
- New product development
- Product introduction
- Supply chain negotiation
- Environmental product declarations
- Cost reduction

#### 4.4.4.4 Success Factors

Elmakis and Lisnianski (2006) described some aspects to consider in order to perform an effective life cycle costing analysis. First of all they said that a team consisting of different people from an organization should conduct an LCC analysis. This, because of the importance to include skills from all of the different areas engineering, finance and accounting, estimating, statistical analysis, reliability and maintainability engineering, logistics and lastly contracting. The head of the group should be a person from the higher parts of the organizational structure with experience from areas such as probability, quality control, system engineering, data analysis and collection and manufacturing methods (Elmakis & Lisnianski, 2006). To avoid a common mistake Elmakis and Lisnianski (2006) suggested that the team assessing the LCC should not be operated from the financial department.

Another crucial aspect for a successful LCC analysis and the implementation of it, according to Elmakis and Lisnianski, is to have top management support for the project. Both their attitude and philosophy thinking toward the reliability of LCC and how to maintain it in the organization will affect the success of it (Elmakis & Lisnianski, 2006).

##### 4.4.4.4.1 Summary of Success Factors

- Put together a team for the analysis work
- Include people from different departments
- Cover a broad range of skills
- The team leader should be a high-level employee
- Separate the team from the financial department
- Top management support

#### 4.4.5 Discussion of Cost Management

Overall, it exists quite a lot of theory regarding cost analysis and purchasing cost models. However it varies a lot between the four cost models that we decided to investigate. There are for example extensive articles regarding TCO and ABC, whereas there are less literature to be found about Landed cost and LCC. Based on the research questions for this master thesis we emphasized the aspects of cost elements and cost drivers as well as application and success factors for each of the studied cost models. These aspects were also discussed to different extent within the existing theory. Table 3 provides a visual measurements of to what different extent the existing theory of the four cost models provides information about the focus areas and overall how much the four different cost models have been discussed among the existing literature. Two plus (++) means that there were extensive information

provided, one plus (+) that there were limited amount of information and zero (0) means that there were none or almost no information at all regarding this.

	TCO	ABC	Landed cost	LCC
Existing theory	++	++	+	+
Cost elements and cost drivers	++	+	++	0
Application	++	++	++	++
Success factors	++	++	+	++

Table 3. Existing theory regarding TCO, ABC, Landed cost and LCC, and some aspects of these cost models.

There was overall quite much information regarding the aspects that we were looking for. However, regarding the cost elements and cost drivers there were a little less information provided. This could also have been affected by the fact that it sometimes was a bit difficult to distinct the actual costs and the drivers apart in the literature. Some of the articles had a different view of it and therefore wrote about cost elements and drivers together as one. We therefore lack some of that information to a great extent within some of the studied cost models. This is the case with ABC, where both cost elements and drivers were listed as costs to consider. Within the theory of LCC there are no information regarding cost drivers and the cost elements were viewed from a very general perspective, being presented only as a few cost categories. However, within the theory of TCO and Landed cost, these aspects were much further assessed and we believe that these provided a lot of knowledge regarding what potential cost elements and cost drivers there might be.

#### 4.4.5.1 Cost Elements & Drivers

First of all, one of the things that differ between the four studied cost models is the scope of them. With TCO and LCC the aim is to cover a products whole life cycle with the cost analysis. Landed cost, on the other hand, is a cost analysis focusing on all the costs related to the transactional phase of the ownership of a product. This leaves out a lot of the cost components and cost drivers that would be included when looking on a product's whole time period. When using ABC the perspective is a bit different. The aim is to analyze what activities that can be linked to a certain product and thereby be able to connect the cost for those activities to that specific product. This means that the view here is more connected to the activities rather than the time period being a product's life cycle. However, it does seem likely that various activities will occur during a product's whole life cycle, due to the needs of that particular product. The scope for this study, and thereby what to include in the cost analysis from the studied system, was decided already in the pre-study part. This due to decisions taken in collaboration with the members of the steering group.

As already mentioned, a broader perspective on what time period of a product's life cycle to include probably goes hand in hand with a more comprehensive cost information to analyze. However, it seems like it is also depending a lot on the products and situation in matter. Several authors have discussed the importance of looking for costs depending on the uniqueness of a certain product or on a specific situation. There is also a discussion regarding the use of more or less standardized cost models, or, if there is no such thing as a standard model for a cost analysis to be accurate and useful. This will in turn lead to different cost elements and cost drivers to search for in a cost analysis.

One thing about what cost elements and cost drivers to seek for in a cost analysis, which is mentioned for several of the cost models, is to prioritize the focus. When doing a TCO analysis for example, it is suggested that it should be assessed if a cost element is of significant matter, for the cost situation of a whole ownership period, for an organization. For ABC it is suggested that the priority should lay on including those activities related to the most expensive resources. This, in order to focus on the cost

elements where the biggest potential cost savings can be made and make sure to include those in the cost model. The same goes for Landed Cost, where emphasis should be put on cost elements that contribute the most significant portion of cost (Feller, 2008).

Another impact on what cost elements that will be included in a model, and how to measure them, seems to be the categorization of the cost elements. As already mentioned, the time aspect is important for some of the cost models, as it is with TCO and LCC, where all costs occurring along a product's life cycle should be included in the model. Yet, most of the categorization of cost elements in the studied literature is not based on when the costs occur but rather on what type of cost it is. Even though this way of categorizing the cost elements are alike in all of the four cost models, the categories varies. There are different categories for the cost elements even within the theory for the same cost model.

However, when taking a closer look at the different cost models, see Table 4, there are some cost categories that are re-occurring in several of them. Cost of operations, production, logistics, inventory, service and maintenance are mentioned as cost categories for several of the cost models. The same goes for different kind of administration costs, and initial acquisition costs or initial price as it is also expressed. The cost categories are somewhat expressed in different ways but we consider for example delivery, distribution and transport cost as a part of the category logistics cost. What to keep in mind is of course that logistics cost then cover a big part of a product's life cycle and that the more detailed categorization aim at pointing on where this logistics cost occur. Overhead costs and cost of risk is two other cost categories that seem important even though they are expressed differently for the different cost models.

Cost Elements			
TCO	ABC	Landed Cost	LCC
<ul style="list-style-type: none"> <li>• Operations Cost</li> <li>• Quality</li> <li>• Logistics</li> <li>• Inventory Cost</li> <li>• Technological Advantage</li> <li>• Supplier Reliability and Capability</li> <li>• Customer-Related</li> <li>• Opportunity Cost</li> <li>• Initial price</li> <li>• Maintenance</li> <li>• Transaction Cost</li> <li>• Life Cycle</li> <li>• Miscellaneous</li> </ul>	<ul style="list-style-type: none"> <li>• Logistics</li> <li>• Production</li> <li>• Marketing and sales</li> <li>• Distribution</li> <li>• Service</li> <li>• Technology</li> <li>• Financial Administration</li> <li>• Information Resources</li> <li>• General Administration</li> </ul>	<ul style="list-style-type: none"> <li>• Price</li> <li>• Transport</li> <li>• Customs</li> <li>• Inventory</li> <li>• Overhead</li> <li>• Risk</li> </ul>	<ul style="list-style-type: none"> <li>• Engineering and development</li> <li>• Initial acquisition</li> <li>• Ownership</li> <li>• Production and implementation cost</li> <li>• Operating</li> <li>• Maintenance</li> <li>• Overhaul</li> <li>• Initial spares</li> <li>• Administration</li> </ul>

Table 4. A summary of the cost elements found for each of the four studied cost models.

The cost categories mentioned above seems to be of highly importance to consider when doing a cost analysis. However, there might be some cost elements that are of less significance in this study. Since the scope is already outlined and regarding the fact that purchasing within Meal Service only is for traded goods. Hence, the purchased goods within Meal Service are not used for manufacturing which makes us consider the production cost to be of less significance for the further study. Another aspect is the fact that the products provided by Meal Service to their customers are disposables, meaning that the customer will only use the product once. This affect the view of how significant impact the category maintenance cost and cost of initial spares will have in this study.

There are both similarities and differences between what cost elements to focus on and include in a cost analysis, and how to categorize them in a cost model. This implies that we need to investigate what cost elements we can find at Duni, and properly assess if and how these costs are connected to the sourcing team within Meal Service and/or the products purchased by this team. The cost categories that seem to be of high significance, regardless of which purchasing cost model that is used in an organization, will nevertheless be important. This gives us a guidance of where to search and whom to interview in order to be able to find answers to the research question *“Which are the relevant cost elements and cost drivers to take into consideration when doing sourcing and economic life cycle decisions at Duni Meal Service?”* But that will only partly answer the question since it also contains the aspect of what drives these costs to arise.

There are extensive theory regarding possible cost drivers for two of the studied cost models, TCO and Landed cost. There are also different ways provided for the categorization of these cost drivers. Within TCO we see one example of how to find the cost drivers by moving along in a typical purchasing process. Another way, that does not include any time aspect of when the costs occur, is to categorize the cost drivers within one of the above mentioned cost categories. These different ways of looking at what drives costs to occur do however result in quite similar cost drivers.

One example is how the supplier drives costs at the purchasing organization. There are several aspects about the supplier that can affect the total cost in different directions. Supplier reliability and capacity, geographical location and payment terms are some examples of these cost drivers. A supplier's ability of adopting to changes and overall service provided by the supplier is also factors that can affect the cost situation, as well as delivery arrangement, packaging and lead time. Related to these cost drivers, are also reliability of carrier as well as duties and tariffs along the transport. The cost drivers related to the supplier and the first part of a product's life cycle are many and recurring in the theory. Therefore it seems important for us to assess these, in our further study. This is also due to the fact that this study only involve traded goods, and Meal Service therefore are relying on their suppliers to get the products that in turn their customers demand.

Other factors that are mentioned as cost drivers, and seems to be of importance, are regarding the purchased item. The uniqueness of the item, perishability, item complexity and design are some of the cost drivers. Other cost drivers related to the product in matter are quality issues, design obsolescence and volume required. Some cost drivers related to the purchased goods, such as long-term usage and spare parts, are less relevant for this study, since Meal Service are dealing with disposables. Once again, the aspect with traded goods is also affecting the significance of cost drivers related to production. This means that factors such as manufacturing, line speed, downtime and production strategy probably will not be found as cost drivers for the total cost of purchasing within Meal Service.

On the other hand, something that will be of importance to consider for the continued study is the cost drivers related to inventory management and warehousing. Storage, safety stock, inventory turnover and scrapping are some of the mentioned cost drivers regarding this. Other potential cost drivers that are mentioned several times in the theory, and that should be considered in the further study, are long-term price stability, exchange rates, environmental issues and disposal cost.

#### 4.4.5.2 Application

There seems to be some similarities regarding the applications and usage areas suggested in the different cost models. To support sourcing decisions is mentioned as an application for the Landed cost. However, this could be interpreted as a pretty broad aspect, where other applications are included as well. One example could be the application to provide data for negotiations, which is found as a use for TCO. This is also similar to one application of LCC where it is suggested to be used to support economic decision makers. Other sourcing decisions emphasize on supplier development, as with the use of ABC for supporting component subcontracting decisions. This is also the case with the suggested use of TCO to develop supplier improvements. TCO is also suggested to be used for supporting supply base decisions (TCO), which is a sourcing decision.

Another sourcing decision that is of high importance is the supplier selection. All of the three cost models TCO, ABC and Landed cost are suggested to be used for supporting supplier selection. It is suggested that LCC could be used to compare and determine the cost-effectiveness of alternative investments, and one could argue that that is in line with the application supplier selection.

Another application that is mentioned in the cost models TCO, ABC and Landed cost is to use them for supplier evaluation. This is also in line with the more specific application of TCO saying that it could be used to measure ongoing supplier performance. These measurements can then be used to compare different suppliers to each other, but also one supplier's performance over a time period. To use it as benchmarking like this is also suggested as an application for TCO. To provide a foundation for performance measurement is also mentioned about ABC. However, performance measurement can of course be inside of the purchasing organization as well.

Moreover, some of the applications of the cost models for issues inside of the purchasing organization can be discussed. ABC is for example suggested to be used to reach manufacturing excellence. This, by supporting decisions about focusing manufacturing strategy, improving operating activities and design products to increase customer value. This is also similar to the use of ABC for output and product range decisions, as well as the application of LCC for new product development and introduction. However, the use for manufacturing issues are outside the scope of this master thesis, since it only involves traded goods. That makes some of these applications less important for this study. One application that could be of interest though is to use the cost model for supply chain negotiations, as mentioned about LCC.

One use of ABC is to provide information about the true costs. This is also found as an application for Landed cost, which is said to provide complete information about both the cost and risk situation. We believe that all of the cost models can be used to provide cost information, since a lot of the other applications are built on the fact that the models provide information and cost data. The information provided from the cost models can in turn be used to identify priorities, an application mentioned about TCO. This is also interpreted by us to be of great use in order to make cost savings, an application for all of the three cost models ABC, Landed cost and LCC. Another application due to the cost information provided from ABC is to gain knowledge about the profitability of a certain product. ABC is also suggested to be used for product or service pricing, one application that surely is because of the cost information the cost model provides. However, ABC is said to be used for cost modeling, an application that seems rather obvious for this study. But ABC could be looked upon slightly different from the other cost models. It is argued in the theory that ABC is a method that should be performed in advance of a TCO analysis. It could therefore be seen as a part of, or a first step, in the TCO analysis. However, a lot of the applications mentioned for ABC are the same, or at least similar, to the applications suggested for the other cost models. The applications for all of the four studied cost models are summarized in Table 5 below.

Applications	
TCO	<ul style="list-style-type: none"> <li>• Support supplier selection for Request for Proposal, Quotation or Bid</li> <li>• Provide data for negotiations</li> <li>• Measure ongoing supplier performance</li> <li>• Identify priorities</li> <li>• Develop supplier improvements</li> <li>• Benchmarking by comparing suppliers' performance</li> <li>• Support supply base decisions</li> </ul>
ABC	<ul style="list-style-type: none"> <li>• Provide information about the true costs</li> <li>• Focus manufacturing strategy</li> <li>• Design products to increase customer value</li> <li>• Improve operating activities</li> <li>• Reach manufacturing excellence</li> <li>• Profitability of a certain product</li> <li>• Product or service pricing</li> <li>• Cost reductions</li> <li>• Support product range, output and component subcontracting decisions</li> <li>• Foundation for performance measurements</li> <li>• Cost modeling</li> <li>• Supplier selection</li> <li>• Supplier evaluation</li> </ul>
Landed Cost	<ul style="list-style-type: none"> <li>• Support and facilitate sourcing decisions</li> <li>• Increase cross-functional work</li> <li>• Strategic supplier selection decisions</li> <li>• Standardize the supplier selection process</li> <li>• Supplier evaluation</li> <li>• Provide complete cost and risk information</li> <li>• Cost savings</li> </ul>
LCC	<ul style="list-style-type: none"> <li>• Compare and determine the cost-effectiveness of alternative investments</li> <li>• Support economic decision makers</li> <li>• New product development</li> <li>• Product introduction</li> <li>• Supply chain negotiation</li> <li>• Environmental product declarations</li> <li>• Cost reduction</li> </ul>

Table 5. Applications and usage areas for each of the studied cost models

#### 4.4.5.3 Success Factors

Regarding the success factors for the different cost models they differ somewhat. Some of them are going more into detail, when others are providing more general factors for success. This could be explained by the fact that some of the factors are focusing on success for the procedure of the cost analysis and the development of the cost model, whilst other are providing recommendations for a successful implementation of the cost model. Some of the success factors are also focusing more on the use and maintenance of the cost model, which is a further aspect of it. Table 6 shows a summary of all of the different success factors categorized into these focus areas.

Success factors	
Procedure & Development	
TCO	<ul style="list-style-type: none"> <li>• Identify unique cost drivers</li> <li>• Use multiple models when analyzing multiple products</li> <li>• Consider the choice of standard or unique model</li> <li>• Base the model development on the nature of the product and the specific situation</li> </ul>
ABC	<ul style="list-style-type: none"> <li>• Gather information by interviewing department managers</li> <li>• Collect the required data in a prioritized order</li> <li>• Start with direct labor and materials cost and then indirect resources</li> <li>• Focus on expensive resources and resources traditionally measured inappropriately</li> <li>• Basically correct is good enough</li> </ul>
Landed Cost	<ul style="list-style-type: none"> <li>• Allow sufficient time frame for a cost analysis</li> </ul>
LCC	<ul style="list-style-type: none"> <li>• Put together a team for the analysis work</li> <li>• Include people from different departments</li> <li>• Cover a broad range of skills</li> <li>• Separate the team from the financial department</li> </ul>
Implementation	
LCC	<ul style="list-style-type: none"> <li>• Top management support</li> <li>• The team leader should be a high-level employee</li> </ul>
Use & Maintenance	
Landed Cost	<ul style="list-style-type: none"> <li>• Organizational structure</li> <li>• Gather information continuously</li> <li>• Consider data collection as an iterative activity</li> </ul>
LCC	<ul style="list-style-type: none"> <li>• Top management support</li> </ul>

Table 6. Success factors for each of the studied cost models, categorized by focus on the procedure and development of the cost model, the implementation of it or the use and maintenance of it.

One of the research questions is “Which are the key critical success factors according to literature in order to successfully implement a purchasing cost model?”. This implies that it is the theoretical aspects on success factors for implementation of the cost model that should be emphasized and also sought for when continuing on with the empirical study. However, the other research question “Which are the relevant cost elements and cost drivers to take into consideration when doing sourcing and economic life cycle decisions at Duni Meal Service?” and also the overall research question “How to successfully develop and implement a suitable purchasing cost model at Duni?” broaden this perspective to include a lot more regarding success factors. Some of the more detailed suggestions are, however, only of interest if that particular cost model will be used for the cost analysis at Duni.<sup>13</sup>

<sup>13</sup> This is for example some of the success factors mentioned for LCC. The suggestions are though difficult to succeed with anyway, since this project is not conducted by a team from the organization. Furthermore none of researchers are a high-level employee at Duni, as also suggested. But these suggestions for success might be helped by the fact that the steering group, covering different levels in the organizational structure as well as different department and different skills, supports this project. This could also be some general words to take with us from the suggestions for LCC; to try covering a broad range of information sources for the continued work. Another important success factor mentioned for LCC is to have top management support. This is something that we recognize from several of our other study courses.

There are some success factors regarding the information gathering that are also more or less detailed depending on for which of the cost models they are suggested. However, we can see that the data collection overall is of high importance and a lot of the success with the cost analysis and the cost model development seems to be depending on the information gathering process. One of the important factors seems to be the time aspect. If the data collection process should lead to as comprehensive information as possible, of course it takes time. In turn, the time frame for the cost analyze will need sufficient time to handle the information. Since both TCO and LCC aims at covering a products whole life cycle, it also indicates that *enough time* is a success factor in order to do a comprehensive cost analysis and provide a complete cost model with true costs. However, the time frame for this study is already decided in advance. Considering that, and with regard to the current status of knowledge and transparency of the cost situation within Meal Service at Duni, the suggestion of how *basically correct is good enough* should be something for the researchers to keep in mind.

## 4.5 Performance Measurements

*“The overall objectives of the purchasing function are that it should obtain the right material, in the right quantity, from the right source, at the right time, at the right place and at the right price.”*

In above way, van Weele (2014) described the overall purpose with the purchasing function. Furthermore he mentioned that purchasing should help reducing the company’s overall supply risk and contribute to product and process innovation. In order to measure and evaluate the purchasing activities, he suggested four dimensions to take into account: price & cost dimension, product & quality dimension, logistics dimension and an organizational dimension which all are shortly described as follows (van Weele, 2014).

### 4.5.1 Price & Cost Dimension

Within this dimension the focus is on the relationship between standard and actual prices paid for materials and services. One parameter is the price & cost control referring to the constant evaluation of prices and price increases charged by the suppliers. The purpose here is to monitor the prices in order to control them and preventing them from getting out of control. In order to do so in example price inflation reports or variance reports could be used. The second parameter within this dimension is the price & cost reduction where the focus is to continuously monitor and evaluate the activities connected to reducing costs in a structured way. This might also include results from searching for new suppliers or materials as well as results from value analysis and co-ordination of purchasing requirements among various business areas (van Weele, 2014).

#### 4.5.1.1 Purchasing Cost Savings

When it comes to defining the measures connected to purchasing cost savings there seems to be no general consensus on how to do it. However, van Weele (2014) described some ways to address the issue. A general distinction is normally made between cost avoidance and cost reductions. Cost avoidances are variances between the historical and the actual purchase price paid per unit, i.e. as a consequence of ordering larger quantities than before resulting in quantity discounts or playing off suppliers against each other. Due to this, cost avoidances are not considered to be sustainable. On the contrary, cost reductions are of a more sustainable character. They might be the result of a change of supplier and/or the change of product specification as some examples, and are therefore reductions that will last for a longer time (van Weele, 2014).

Due to the fact that the purchasing activities should work cross-functional within the organization it is hard to connect the purchasing savings specifically to the purchasing department. Furthermore it might be misleading to only report cost savings connected to price effects due to the various areas that might also be affected. Therefore purchasing savings should be reported at a company level rather than at only at the purchasing department level (van Weele, 2014).

In order to have a successful company-wide purchasing cost reduction, van Weele (2014) discusses some important parameters to take into account. Firstly, it is important to have clear saving targets agreed that will not change during the cost reduction time. Second, the buyers should not be measured upon external factors, such as raw material costs or market prices, which they cannot influence. Finally, due to credibility reasons purchasing cost savings should be part of the general management reporting, reported by business controlling, rather than by the purchasing managers themselves (van Weele, 2014).

#### 4.5.2 Product & Quality Dimension

This dimension refers to purchasing's responsibility with regard to the quality of purchased materials, both when it comes to purchasing's involvement in new product developments but also the contribution to a total quality control. When it comes to the product innovations it is important that the new product plans in terms of target cost and time to market are in line with how all the involved disciplines work, including the purchasing function and suppliers. The number of engineering hours spent by suppliers or the project's overall lead time could in example measure this. Furthermore, after the specification is done it is purchasing's job to make sure that ordered goods are delivered according to the specification. Here some measures, as number of approved suppliers or reject rates on incoming goods, could be used as an indication of to what extent the company is able to secure a faultless flow of incoming materials from the suppliers (van Weele, 2014).

#### 4.5.3 Logistics Dimension

As a third key performance area van Weele (2014) described the importance of purchasing's role in contributing to an efficient incoming flow of purchased materials and services. This includes the control of timely and accurate handling of purchasing demands, control of timely deliveries from suppliers and control of delivered quantities. In order to control and improve supplier performance in terms of quality and delivery reliability techniques as supplier evaluation and vendor rating could be used (van Weele, 2014).

#### 4.5.4 Organizational Dimension

The fourth and last dimension mentioned by van Weele (2014) includes the major resources used to achieve the goals and objectives of the purchasing function. The first resource mentioned is the purchasing staff, including the background, level, training and development and competencies of purchasing personnel and its costs. The second resource is the purchasing management, referring to the set-up of the purchasing department and its quality and availability of purchasing strategies, action plans and reporting procedures. It also includes the management style and communications structure. Furthermore it is important to have clear procedures and guidelines for purchasing staff and supplier together with sufficient information systems, to make sure that the work is done in the most efficient way (van Weele, 2014).

In order to make a comprehensive assessment of the purchasing organization and to monitor both effectiveness as well as efficiency, each of the above-mentioned dimensions need to be considered, individually and collectively. Furthermore the interrelation among them needs to be taken into account in order to get the lowest total cost of ownership and the measurements and reporting systems need to be tailored to the specific needs of the evaluated company (van Weele, 2014). The using of a purchasing cost model will contribute to the measuring of the purchasing performance. Moreover, Ellram (1994) described performance measurement as a benefit of using a purchasing cost model (TCO) since it is a good framework for evaluation of suppliers, a concrete way to measure results of quality improvements efforts and finally an excellent tool for benchmarking.

#### 4.5.5 Key Performance Indicators, KPIs

Taking the above-mentioned dimensions into account, performance could be measured with KPIs, Key Performance Indicators. These performance indicators can be used and classified in various ways. According to Carter and Mosconi (2005) they can be differentiated between ratios connected to price/cost, revenue, inventory, availability, technology/innovation/new product introduction, workforce,

supplier performance, operations and customer satisfaction (cited in van Weele, 2014). Due to the scope of this thesis we limit the measurements described to the ones connected to financial performance, cost and purchasing logistics. In order to evaluate performance within these areas i.e. the following measures are available:

**Financial performance:**

- Cost of goods sold/sales
- Scrap cost as % of total sales
- Days in inventory
- Net income
- Number of profitable customers
- Sales growth rate
- Return on capital employed

(Parmenter, 2009)

**Costs:**

- Cost relative to competitors
- Direct/indirect labor cost
- Total product cost as a function of lead time
- Inventory cost
- Scrap cost
- Cost of quality
- Distribution cost

(White, 1996)

**Ordering:**

- Purchasing administrative lead-time
- Purchasing order backlog per month
- Number of requisitions processed per month
- Number of supplier quotations obtained per month
- Number of orders issued per month
- Number of rush orders per month.

(van Weele, 2014, s. 298)

**On-time delivery:**

- Number of on-time deliveries
- Number of late deliveries
- Number of deliveries made too early
- Number of incomplete deliveries
- Premium transportation cost due to rush orders

(van Weele, 2014, s. 299)

**Payment:**

- Average payment term versus standard payment term
- Number of invoices processed
- Number of non-matching invoices
- Average invoice value
- Number of invoices per supplier

(van Weele, 2014, s. 299)

### Supply-chain efficiency:

- Percentage non-moving inventory
- Material shortages per month
- Number of partial deliveries
- Number of all rush orders
- Inventory turnover ratio per month
- Inventory value per month
- Number of outstanding orders (quantity and volume) per month

(van Weele, 2014, s. 299)

It is important that the purchasing management is aware that only part of these measurements can be connected to the suppliers. Many of these logistics problems are results of insufficient materials planning and requisitioning by the own company. In example if purchase orders are changed repeatedly this could lead to that timely and flawless deliveries from the supplier is almost impossible. Another example is if internal departments are having purchase demand without any respect to supplier's lead time, this could lead to a high number of rush orders and unnecessary distribution cost. Therefore, van Weele (2014) recommended that purchasing managers should differentiate between internal and external performance indicators. He also stated *"every company gets the supplier that it deserves"* (van Weele, 2014).

#### 4.5.6 Application of KPIs

In general it can be unrealistic to have sufficient KPIs for all suppliers and products within a company, which makes it important for the company to decide for what scope such measurements are required. Van Weele (2014) described two potential distinctions that can be made. The first one is the one between critical and non-critical deliveries, where critical deliveries are the ones that beyond their delivery date puts the company's business processes in immediate danger. The other distinction could be made between products obtained from problematic suppliers, and those that are crucial in order to keep the business processes intact. Products can in example be crucial if they cannot be kept in stock, or if they are in a critical step of project planning (van Weele, 2014).

Moreover van Weele (2014) argued some other problems with above-mentioned measures for purchasing performance. One example is the lack of a direct relationship between the resources (input and output) used in purchasing processes and the results connected to these. A consequence of this is of course that purchasing as a business unit is less measurable compared to for example production activities where there are a more direct flow between input and output resources. Therefore purchasing management should make sure to use measures covering each of the four dimensions of purchasing performance and to develop both purchasing effectiveness and efficiency (van Weele, 2014).

## 4.6 Synopsis of the Theoretical Framework

In this section the key takeaways from the theoretical framework are summarized. These will then be analyzed together with the empirical data from chapter five.

### 4.6.1 General

#### 4.6.1.1 *Purchasing Management*

From the theory about purchasing management it is clear that cross-functional integration within the company is a crucial part in order to have a successful purchasing process. It is important that the decisions taken by the purchasing function are aligned with the overall business strategy and that the decisions focus on optimizing the total cost of ownership rather than only to find the lowest price.

Furthermore the purchasing function should make sure that they focus on their core tasks and responsibilities, which from the theory can be summarized as:

1. Operational Excellence – securing timely and unobstructed availability of purchased goods
2. Cost control – spend management when it comes to cost control and reduction of all purchasing-related spends
3. Risk management – to reduce the company's risk exposure toward its supply markets
4. Continuous improvement – to look for potential partnerships with suppliers in research development project

By focusing on these and by having clear rules and guidelines and a professional administrative organization in place, the chances of having a successful purchasing process increases a lot.

#### 4.6.1.2 *Contextual Aspects*

The key take-away about trade companies and trade business areas within a company, as in this case, is that it is processes besides the production process that is value added. Therefore the buying function together with logistics, both inbound and outbound, are major activities. The trade company fulfills their function by being an intermediary between the producer and the end user and some crucial activities for the function are bulk breaking, storage, transportation and building up a sufficient product assortment; activities that the trade company should be able to execute more efficiently than the manufacturers. By being good at these activities value-add will be brought into the trade organization and the purchasing management will fulfill its purpose.

### 4.6.2 Cost Management

The discussion regarding the four studied cost models and the particular aspects; cost elements and drivers, application and success factors leads to some key takeaways from the theoretical framework. It also gives us a lot of understanding and knowledge about the subject of cost analysis and particular purchasing cost models. When continuing with the empirical data collection we will use this knowledge and try to gather information about what cost elements there are at Duni, and what drives them to arise. We will also look for their opinions regarding application of the cost model and success factors for implementing and maintain it. One of the key takeaways from the theoretical framework is indeed to seek information on a broad perspective to get a holistic view and to minimize the risk of missing out on some important aspect.

Besides providing a deeper knowledge about the studied cost models, the analysis will later on be based upon the theoretical framework. The key takeaways from the theoretical framework of the cost models, that will be compared with the findings from the interview study and discussed in the analysis, are summarized in Table 7.

Key takeaways		
Cost Elements	Applications	Success factors
<ul style="list-style-type: none"> <li>• Initial price</li> <li>• Transaction</li> <li>• Customs</li> <li>• Transport</li> <li>• Logistics</li> <li>• Inventory</li> <li>• Ownership</li> <li>• Operations</li> <li>• Overhead</li> <li>• Administration</li> <li>• Marketing and sales</li> <li>• Service</li> <li>• Engineering and development</li> <li>• Supplier Reliability and Capability</li> <li>• Quality</li> <li>• Risk</li> </ul>	<ul style="list-style-type: none"> <li>• To support different kind of sourcing decisions</li> <li>• Supplier selection</li> <li>• Supplier development</li> <li>• Supplier evaluation</li> <li>• Performance measurement</li> <li>• Other usage areas due to the providence of cost information</li> </ul>	<ul style="list-style-type: none"> <li>• The importance of the empirical data collection</li> <li>• Cover a broad range of information sources</li> <li>• Consider the uniqueness of products and situations within the cost analysis</li> <li>• Emphasize cost elements and drivers with significant contribution</li> <li>• Consider standard vs. unique cost model</li> <li>• Assess whether any of the studied cost models are suitable for this project and the studied system</li> <li>• The time frame</li> <li>• Basically correct is good enough</li> <li>• Top management support</li> </ul>

Table 7. A summary of the key takeaways regarding cost elements, applications and success factors for the four studied cost models.

#### 4.6.3 Performance Measurements

Four important dimensions to take into account when measuring purchasing performance were mentioned: price & costs, product & quality, logistics and an organizational dimension. In order to make sure that the performances within these dimensions are measured sufficiently, Key Performance Indicators (KPIs) can be used. Some KPIs relevant to this thesis was listed within the following areas: Financial performance, costs, ordering, on-time delivery, payment and supply chain efficiency. However, it can be unrealistic to have sufficient KPIs for all suppliers and products within a company. It is therefore important to decide for what scope such measurements are required. Nevertheless, the measurements chosen should cover each of the four dimensions of purchasing performance in order to develop both purchasing effectiveness and efficiency.

## 5 Empirical Data

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*This chapter includes the empirical data. First it will be described how an interview guide was carried out with purpose to find the relevant information regarding Duni. Then the findings from the interviews will be presented, divided by department. Furthermore these findings will be discussed and the chapter will be concluded with a synopsis of what key findings that have been made in this chapter.*

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### 5.1 Interviews

In order to firstly get a good view of the current situation at Duni and then further to get valid information and data from all important areas within Duni, a lot of interviews have been held.<sup>14</sup> In this section the outcome of the interviews will be presented. First it is described how the interview guide was prepared and created and then are the findings from all of the interviews presented. This information is divided upon general information, cost elements and drivers, application, success factors and performance measurements. The interviews are also divided into the different functions within Duni and the various information gained from various roles within the same department are then summarized. Finally, all interviews are discussed and summarized into a synopsis.

#### 5.1.1 Interview Guide

There was one interview guide<sup>15</sup> for all of the interviews, in order to gain knowledge about the most important aspects for this study. This contained questions regarding cost elements and drivers, potential application of a cost model and success factors for it. Due to the identified background issues, there were also questions regarding performance measurements, and general questions to gain understanding about the level of collaboration and how they worked cross-functionally in the organization.

#### 5.1.2 Meal Service Interviews

Within the Meal Service business area a lot of interviews have been held, both in the beginning and further into the project. The outcome from the interviews is presented below, divided between the various functions of the business area.

##### 5.1.2.1 Sourcing Team

The members of the sourcing team are the one seen as the main user of the cost model. It was therefore really important to involve them early in the preparation of the model to make sure that they felt involved in the development. Interviews were held both individually and in a group with the five members.

##### 5.1.2.1.1 General

All of the members within the sourcing team seemed to have a positive attitude towards this master thesis. They looked forward to what findings we would make in the study, as well as to the construction of the purchasing cost model and how they would be able to integrate it in their work.

The sourcing team communicates a lot with the category managers within Meal Service and they believe that their collaboration is working well. On the other hand, they have less collaboration with both sales and logistics. But the sourcing team does believe that the category managers work as a well-functioning middle hand for the communication between them and sales. Regarding the lack of collaboration with the logistics department, they would prefer both better and more regularly communications with them. The members of the sourcing team sometimes feel as if they are hunting logistics employees to get information that they need. Other times they think that the logistics are reaching out to them to hand over typical logistics problems to the sourcing team instead.

##### 5.1.2.1.2 Cost Elements & Drivers

It was quite hard, in the beginning, to get a good discussion with the sourcing team about the costs and their drivers. One of the reasons why Meal Service had requested this thesis was the fact that they had

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<sup>14</sup> All of the interviews that have been held are listed in *Appendix 4*.

<sup>15</sup> The interview guide can be found in *Appendix 3*.

quite poor control about their costs. It was clear in the interviews that this really was the case and that they had little notice about the actual costs in their product life cycle. However, some costs and cost drivers were suggested and discussed, see Table 8.

Cost Elements	Cost Drivers
<ul style="list-style-type: none"> <li>• Extra cost for customized products</li> <li>• Operational costs, e.g. inventory cost</li> <li>• Cost for repacking due to damages</li> <li>• Purchase price</li> <li>• Cost for palletizing</li> <li>• Safety stock at supplier</li> <li>• Transport (freight)</li> <li>• Quality</li> <li>• Warehousing cost</li> <li>• Scrapping cost</li> </ul>	<ul style="list-style-type: none"> <li>• MOQ – minimum order quantity</li> <li>• Possible quantity per pallet to get the best freight price</li> <li>• MPQ – minimum production quantity</li> <li>• Material and printing for purchase price</li> <li>• Currency</li> <li>• Payment terms</li> <li>• Lead time</li> <li>• Tool or mold capability by suppliers (in-house cost less)</li> <li>• Lamination capability by suppliers (in-house cost less)</li> <li>• Production capability by supplier</li> </ul>

Table 8. Cost elements and drivers suggested by the sourcing team.

From the elements presented in Table 8 it was only purchase price and freight cost that were mentioned by more than one members of the sourcing team. A reason for this might be that these costs are the ones that the sourcing team already uses in their product cost calculations today and that they did not have much notice about the other costs involved. Furthermore some costs within the warehouse and connected to inventory were mentioned but it was clear that the sourcing team did not know a lot about costs involved in this part of the supply chain.

When it comes to the drivers it was even harder to get any suggestions from the members. The authors needed to clarify the question a few times and to add leading questions as “what do you negotiate about with the suppliers” and “what parameters might affect the product price in a specific way”. This made that almost all drivers were connected to the suppliers and it was clear that the sourcing team mostly had the suppliers in mind and things connected to their negotiations during this whole discussion. The authors tried to get suggestions of other drivers throughout the supply chain as well but did not succeed. It was clear that there was a lack of understanding for the whole supply chain within the sourcing team.

#### 5.1.2.1.3 Application

When discussing the applicability of the cost model the sourcing team members had many ideas about this. It was clear that our supervisor and his manager had a lot of ideas about the usage since they were the ones behind the request of this thesis but the other members had some visions as well.

One commonly mentioned application was to show the actual cost of the products and by this to gain visibility into the business. With this they wanted to be able to gain knowledge about where to find potential cost savings and what to improve to increase a product’s profitability. With this information they could see potential to evaluate a product’s profitability and to use the output of the model as support in decision-makings in meetings, i.e. when it comes to phase out decisions.

The supplier selection process for new products was mentioned, where they could use the model to compare alternatives and to see how various parameters might or might not affect the total cost of a product. In negotiations the model could work as a support to give indications about how the total cost of a product will look like.

Finally it was clear that one goal with the model was to be a linkage between different functions at Duni and to help increase the collaboration between them. The sourcing team members had notice that it sometimes was hard to “speak the same language” between various functions within Duni, and that such a model could make it easier to communicate about costs throughout the supply chain.

#### 5.1.2.1.4 Success Factors

Regarding the success factors all members of the sourcing team agreed that the simplicity of the model was the key factor that would decide whether the model would be used or not. It was required that the model should be both easy to understand and easy to use and that the solution should be simple in its appearance. Furthermore it was desired that it should be possible to get a graphical view out of it to easier show results and to do analysis.

Finally, one wish was that the model should be localized and thereby accessible everywhere. This request was based on the fact that many negotiations with Asian suppliers might be in small areas without access to Internet. Then the users still want to be able to use the model by having it locally at their computers without the need to connect to specific systems.

#### 5.1.2.1.5 Performance Measurements

The sourcing team use KPIs for performance measurement. They have four different KPIs, which are *cost savings*, *delivery reliability* (from supplier), *contracted spend* and *raw material clause coverage*. These KPIs also breaks down on individual level within the sourcing team depending on what suppliers each person is responsible for. The interviews showed signs of how the focus on KPIs varied within the sourcing team. There were also some different opinions regarding how good these KPIs are as performance measurements. Some members of the sourcing team thought that delivery reliability and raw material clause coverage could not be measured properly. One of them even said that due to this they were not to consider as KPIs. However, the whole sourcing team has been involved in the discussion about what KPIs they should have and overall they think it is good that they have some KPIs for performance measurements since they lacked this before.

#### 5.1.2.2 Category Managers

The category managers are seen to be the second potential users of the cost model in product assortment decisions. There are two category managers in the Meal Service business area and they were both interviewed individually.

##### 5.1.2.2.1 General

The category managers were also looking forward to the result of this project. One of them believed that if the construction of the cost model could give Meal Service a better transparency, it would provide the whole department with the same view of the total cost and profitability situation. This would in turn align the different work functions and probably make everyone involved strive towards a more common goal. He especially emphasizes how this could have a positive impact on the collaboration between the category managers and the sourcing team, even though they already have a good relationship. Another function that the category managers have a good communication with is the sales function. However, there are potential for improvements in their collaboration as well. One of the category managers feels that the sales team has too much opinions and influence regarding the assortment and what products to sell, even though that is the category managers area and decisions.

On the contrary, the category managers feel that the Supply Chain function should be involved to a greater extent. They would like to get more input and advice from them. One of the category managers feels as if the Supply Chain employees are turning to him for answers that they should provide him with, or at least give their perspective on the matter. The same category manager does, however, feel that they have a good communication and can get a lot of guidance from the forecast planners when involving them into a new product project. But he does emphasize the importance of including them in the right moment of the process, and as it is today the forecast planners are introduced toward the end of a

project. One of the functions within the Supply Chain department that they seem to have the least collaboration with is the logistics.

#### 5.1.2.2.2 Cost Elements & Drivers

The cost elements and drivers mentioned by the category managers are presented in Table 9.<sup>16</sup> The category managers admitted that they had little knowledge about all costs connected to a product and that their decisions regarding the product assortment mostly were based on the market needs rather than how it would affect the supply chain.

Cost Elements	Cost Drivers
<ul style="list-style-type: none"> <li>• Scrapping cost</li> <li>• Freight</li> <li>• Purchasing price</li> </ul>	<ul style="list-style-type: none"> <li>• Phase in</li> <li>• Product type</li> <li>• Different market demand</li> <li>• Market price</li> <li>• Phase out</li> <li>• Number of articles</li> </ul>

Table 9. Cost elements and drivers mentioned by the category managers.

The cost elements and drivers mentioned were mostly connected to the product itself and how the market influences the final costs of a product. Both category managers mentioned the scrapping cost and they described how this cost was something that no one seemed to have control over or knowledge about who was responsible for it. Furthermore they discussed that the number of articles, and the complexity that this bring, might be a major driver of the overall product cost and that their processes around phase in and phase out decisions might lead the development of this in the wrong direction.

#### 5.1.2.2.3 Application

Both category managers could see a lot of potential application areas for the cost model in their work. First of all they could see the benefit of clarifying and visualizing the actual costs of their products, which could work as support in their decision-making regarding phasing out articles. They could also see the potential of the model showing expected losses and where cost savings could be made.

Furthermore it was discussed that a cost model like this could, by its holistic view of the costs, align various departments within Duni and make them work in the same direction. This might then, in the longer run, help Duni to evaluate their internal policies to make sure that the whole organization work towards the same goals.

#### 5.1.2.2.4 Success Factors

The category managers mentioned that the simplicity of the model was of particular importance. A suggestion was to only include a handful of parameters that affect the total cost in order to make the usage easy. They also mentioned that the internal policies at Duni might be an obstacle in the usage of the model.<sup>17</sup> Otherwise the category managers thought that the model would be used, if it was promoted in the right way and user friendly.

<sup>16</sup> As can be seen in Table 9, only a few cost elements were mentioned and this was a consequence of both lack of knowledge but also that the focus on these interviews were on many various things.

<sup>17</sup> If the output from the model would indicate some troubles or issue areas, the internal company policies might, anyhow, have an impact on what and if actions are taken. The internal company policies are probably not something that we can affect during this thesis, only be aware of that it exists.

#### 5.1.2.2.5 Performance Measurements

The category managers also use some KPIs to measure performance. The three KPIs that they measure are *residual value*, *top line growth* and what is called *CB1*<sup>18</sup> within Duni. The term CB1 is a value of profitability for Meal Service products. This is, though, a KPI that one of the category managers does not believe is good for performance measurement.

#### 5.1.2.3 Other Meal Service Interviews

In addition to the users of the model, some other interviews were held at Meal Service to gain a wider understanding of the situation. These interviews were held with the director and the business controller at Meal Service. The output from their interviews will be described in the following sections.

##### 5.1.2.3.1 General

The attitude towards this master thesis was especially positive from the director of Meal Service since he was part of the steering group. However, the business controller for Meal Service was also very supporting and hoped that the development of the purchasing cost model could provide better insight about the trade-offs related to a sourcing decision. The director of Meal Service described how they made some big focus changes within Meal Service in 2012. The goal was to increase the profitability of Meal Service's products and meet the market demand. Four different focus areas were developed in order to reach these goals. Firstly, they would work towards being more concept oriented in order to drive growth. They would also increase the efficiency of sales by addressing "bigger" customers. The third focus area was to improve the purchasing within Duni, and especially by emphasize on cost savings that could be done by the sourcing team. Lastly, they decided to develop and improve the business culture within Meal Service. They were to be more transparent and become better at raising questions and highlight issues. This would in turn give the employees courage to take decisions, and dare to learn by mistake instead of hampering the development by not taking any decisions. The director described that the purpose with the four cornerstones of the new business development was for the Meal Service to create better products and to work more cost efficient, and thereby reach their overall goals. The business development has, according to the director of Meal Service, been a huge success and given them great results. However, the work is an ongoing process and this master thesis study is a part of that continuous improvement.

##### 5.1.2.3.2 Cost Elements & Drivers

Especially the Meal Service controller contributed with ideas about the cost elements and drivers to potentially include in the model, see Table 10. It was clear that the controller was aware of a lot of costs in the supply chain and had opinions on which to include in a cost model. Moreover, the business controller suggested warehouse costs, though he did not provide us with detailed knowledge about the various costs connected to the warehousing.

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<sup>18</sup> CB1 means that it is the first level of cost breakdown that Duni does. They also have CB2 (which is discussed later on in this thesis) and CB3.

Cost Elements	Cost Drivers
<ul style="list-style-type: none"> <li>• Purchase price</li> <li>• Inbound freight</li> <li>• Customs duties</li> <li>• Outbound freight</li> <li>• Packaging cost</li> <li>• Fix warehouse cost (human resources)</li> <li>• Variable warehouse cost (human resources, external warehouse (rent, transport))</li> <li>• Internal freight</li> <li>• Scrapping</li> </ul>	<ul style="list-style-type: none"> <li>• Delivery performance by supplier (Safety stock at supplier)</li> <li>• Incoterms</li> <li>• Payment terms</li> <li>• Commitments</li> <li>• Transportation option</li> <li>• Phase in/out</li> <li>• Re-packing/handling at port</li> <li>• Norrköping vs Bramsche warehouse (place of safety stock)</li> </ul>

Table 10. Cost elements and drivers mentioned in these interviews.

Regarding the suggested drivers they were also widely spread throughout the supply chain, including both financial drivers such as payment terms and incoterms as well as more product assortment connected drivers such as phase in and phase out decisions.

#### 5.1.2.3.3 Application

Several various suggestions came up regarding applicability. One application area mentioned both by the director and the controller of Meal Service was support for sourcing decisions and to steer the sourcing team in their work. The director also argued that the first users of the model should be the sourcing team and that the category managers' usage of the model should be prioritized if possible in a later stage of the development.

The model should also show the holistic picture of all the costs so that the users in the future will look beyond the purchasing price only. They should also be able to use the model to optimize the parameters, so that the lowest possible cost is obtained and potential cost savings could be identified.

Another request was visualization of potential trade-offs when product related decisions are made, i.e. to buy a large volume to a lower price vs. the higher inventory costs that this might lead to. Then the users might be able to optimize these trade-offs and to make sure that the best solution possible is chosen.

#### 5.1.2.3.4 Success Factors

For success factors it was important that the model initially should be developed on a small and basic scale, and that Duni could continue with more advanced and detailed developments later on. The suggestion was to think "*less is more*" regarding the variables and aspects to include, rather than to make the model complex. Also that the cost parameters in the model should affect the total cost but also be costs that can be affected by the sourcing team. This in order for the users to really feel the ownership of the model's results and to stay motivated that they really can affect the model's outcome.

#### 5.1.2.3.5 Performance Measurements

The new focus areas developed in 2012, within Meal Service, led to changes in their way of working. The KPIs that Meal Service has today is used to support the work towards reaching the overall goals for the Meal Service business. One example is the focus on cost reduction, to increase profitability, and therefore they use cost savings as a KPI within the sourcing team of Meal Service. An additional KPI that is mentioned by the director of Meal Service is the number of articles in their assortment. However, he does believe that they are going to phase in more articles than they are going to phase out during the year to come.

#### 5.1.2.4 Summary of Meal Service Interviews

In this section a short summary of the Meal Service interviews follows.

#### 5.1.2.4.1 General

- Positive attitude towards this master thesis study and what result this project can provide them with
- Part of the ongoing business development process within Meal Service
- There is a need for aligning the different work functions and strive towards a common goal
- The communication within Meal Service is working well but there is potential for improvements
- There is a lack of collaboration between Meal Service and functions within the Supply Chain department, especially the logistics team
- There is a need for better and more regularly communication between Meal Service and the Supply Chain department

#### 5.1.2.4.2 Cost Elements & Drivers

Several interviewees mentioned the same cost elements and drivers. The summary of the mentioned cost elements and drivers are presented in Table 11.

Cost Elements	Cost Drivers
<ul style="list-style-type: none"> <li>• Customization cost</li> <li>• Inventory cost</li> <li>• Cost for repacking due to damages</li> <li>• Purchase price</li> <li>• Palletizing cost</li> <li>• Safety stock at supplier</li> <li>• Freight cost (inbound/outbound/internal)</li> <li>• Quality</li> <li>• Warehousing cost (fix/variable)</li> <li>• Scrapping cost</li> <li>• Customs duties</li> <li>• Packaging cost</li> </ul>	<ul style="list-style-type: none"> <li>• MOQ</li> <li>• Re-packing/handling at port</li> <li>• MPQ</li> <li>• Material and printing for purchase price</li> <li>• Currency</li> <li>• Payment terms</li> <li>• Lead time</li> <li>• Supplier capability (tools/production/lamination)</li> <li>• Phase in/out</li> <li>• Product type</li> <li>• Different market demand</li> <li>• Market price</li> <li>• Warehouse and safety stock location</li> <li>• Number of articles</li> <li>• Delivery performance by supplier</li> <li>• Incoterms</li> <li>• Commitments</li> <li>• Transportation option</li> </ul>

Table 11. Summary of Meal Service mentioned cost elements and drivers.

#### 5.1.2.4.3 Application

The application areas are:

- Usage in supplier selection decisions
- To show the true costs and show a holistic view of the cost situation
- Bring transparency/visibility
- Visualization of potential trade-offs
- Highlight potential cost savings
- Support sourcing decisions
- Support phase in and out decisions
- To connect different functions at Duni, by increasing the visibility and the collaboration between functions

#### 5.1.2.4.4 Success Factors

The following success factors in the usage of the cost model were mentioned:

- Simple in its appearance
- Easy to use
- Easy to understand
- Start the development in a small scale
- Possibility to use the model offline
- Show a graphical view of the results

#### 5.1.2.4.5 Performance Measurements

Within Meal Service the following KPIs are used to measure performance:

- Cost savings
- Delivery reliability (from supplier)
- Contracted spend
- Raw material clause coverage
- Residual value
- Top line growth
- Number of articles in the assortment

### 5.1.3 Supply Chain Function Interviews

It was clear that the Supply Chain function also would play an important part in this thesis and a lot of interviews were held with various persons within the function. The Supply Chain function was not seen as an initial user of the model themselves, but responsible for most of the input data to the model. In this section the interviews are divided into two different categories: Bramsche interviews and other interviews. This categorization was made based both on the purpose with, and the outcome from, these interviews.

#### 5.1.3.1 *Bramsche Interviews*

In Bramsche the central warehouse of Duni is located and almost all of the central Supply Chain employees are placed. The interviews were held with the Supply Chain director, the logistics director, the freight manager, the business controller for operations and two of our head contacts, a system developer and the business controller for logistics.

##### 5.1.3.1.1 General

All of the interviewees in Bramsche were happy to hear about this project and were eager to help us. Some were very keen on stressing the need for more cost transparency. They felt a lack of understanding from other parts of Duni about the logistics. They also said that there were too little knowledge about the true costs of the logistics and regarding the total cost of a product. Due to internal company politics the logistic function do not invoice the business areas all logistic costs.<sup>19</sup> The logistics business controller mentioned this as a possible answer to the lack of knowledge about the true cost situation, and thereby a reason for misunderstandings.

Several of the interviewees shared the same opinion about communication and cooperation issues between them and other parts of Duni. There were also opinions regarding how well this functioned in general inside of the organization. They did for example believe that some of the current problems they handle could have been avoided if other functions within Duni had communicated and worked more cross-functional. The problematic situation would also have been improved if Duni did more follow-ups and comprehensive evaluations of their products and their work.

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<sup>19</sup> The logistic function is showing a negative result each year.

### 5.1.3.1.2 Cost Elements & Drivers

Regarding the cost elements and cost drivers it was clear that the interviewees had a lot of suggestions in both categories, see Table 12.

Cost Elements	Cost Drivers
<ul style="list-style-type: none"> <li>• Scrapping cost</li> <li>• Inbound freight</li> <li>• Palletizing</li> <li>• Storing cost (internal/external)</li> <li>• Handling cost inside the warehouse</li> <li>• Cost of quality issues</li> <li>• Fixed warehouse costs</li> <li>• Variable warehouse costs</li> <li>• Warehouse administration cost</li> <li>• Internal freight</li> <li>• Warehouse depreciation cost</li> <li>• Packaging cost</li> <li>• Inventory cost</li> <li>• Cost of keeping discontinued articles</li> <li>• Customs duties</li> <li>• Currency risk</li> <li>• Tied up capital</li> </ul>	<ul style="list-style-type: none"> <li>• MOQ</li> <li>• MPQ</li> <li>• Obsolete articles</li> <li>• Product type (seasonal or slow mover)</li> <li>• Storage location</li> <li>• Bottleneck at the receiving area</li> <li>• Lead time</li> <li>• Truck load</li> <li>• High stock levels</li> <li>• The structure of managing costs</li> <li>• Sales incentives</li> <li>• DOI - days of inventory</li> <li>• Incoterms</li> <li>• Warehouse capacity</li> <li>• Pallet load (full or mixed)</li> <li>• Warehouse productivity</li> <li>• Sales estimates</li> <li>• Forecast planning</li> <li>• Poor communication</li> <li>• Supplier packing quality</li> <li>• Phase in/out</li> <li>• Safety stocks</li> <li>• Supplier negotiation</li> <li>• Customer returns</li> <li>• Commitments</li> <li>• Inventory management</li> <li>• Delivery performance to customer</li> <li>• Number of articles (complexity)</li> <li>• Scrapping process (limits)</li> <li>• Supplier location (Asia/Europe)</li> <li>• Order structure</li> <li>• Payment terms</li> </ul>

Table 12. Cost elements and drivers discussed in Bramsche interviews.

Regarding the cost elements the focus was clearly on costs connected to the warehouse and areas around it. More detailed information about costs in the warehouse were mentioned, such as storing cost, handling cost, discontinued articles and inventory cost, were mentioned by almost all of the interviewees. It was clear that the Supply Chain function had a good knowledge about costs involved in their part of the business.

Regarding the drivers, a lot of potential cost drivers were mentioned as can be seen in Table 12. The cost drivers that most mentioned were MOQ, lead-time, high stock levels, DOI and sales estimations. Since they all are connected to the amount of pallets in the warehouse, this was not surprising although it was good to get their perspective of the situation. Regarding the sales estimations we got information and statistics showing that the sales estimations often were wrong, which of course affects the warehouse a lot.<sup>20</sup> It was also mentioned that the poor communication between departments, and within the organization, might have a large role in driving high costs, since the flow is not optimized.

#### 5.1.3.1.3 Application

The collective opinion was that the prior purpose and usage was to make the value chain transparent, showing all true costs. The model could then also be used to visualize the warehouse situation by showing high inventory levels and how to lower the storage volume in the future. Then there would be a gained knowledge of the total cost perspective within Duni, and the model could be used as a support in decision-makings all over the organization. It was also suggested that the model should show trade-offs between costs so that the users will know what consequences to expect when taking a specific decision.

#### 5.1.3.1.4 Success Factors

Three important success factors were mentioned:

- Assign one person responsible for the model in order to make sure that the model is used and updated correctly
- The model needs to be updated *at times when the workload from other tasks is a bit lower*
  - o Especially the logistics business controller in Bramsche has a workload that varies a lot over time and since she plays an important role in the data input process that might be important to take into consideration
- Calculate with the true costs
  - o Currently Duni uses certain adjusted costs in some calculations due to internal company politics, however to be able to show the true total cost of ownership it was declared that the actual costs need to be used

#### 5.1.3.1.5 Performance Measurements

Regarding the freight, for example, two of the KPIs used by the Supply Chain function are how the forwarder (Schenker) meets the lead times, and the average size of a truckload. The logistics director mentioned how they recently developed some new KPIs for the warehouse performance. Before, they only had one KPI regarding the effectiveness of the picking process in the warehouse. They are now aiming at increasing the effectiveness for several parts of the warehousing and are, for example, taking daily measurements of the stock levels. The business controller of the logistics department continuously works with the KPIs and also tries to seek for new performance measurements. The quest for cost efficiency of the logistics department does, however, seem to be constrained by internal politics.

#### 5.1.3.2 Other Supply Chain Interviews

In this section the compilation from the interviews with the Supply Chain director and employees in the supply-planning department, in Malmö, are presented.

##### 5.1.3.2.1 General

The director of the Supply Chain department are included in the steering group for this master thesis and had very positive thoughts about this project. He emphasized the scope of the study and also how to maintain a cost model, once it is implemented. The other interviewees did also see the value of doing a cost analysis within the Meal Service department, and one of them were also part of the steering group

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<sup>20</sup> One might think that the information regarding incorrect sales estimations was brought up to blame current issues on another department. There might be a truth in it, however since cost drivers as warehouse productivity and capacity issues also were mentioned it seems like they have a good self-awareness about their role in the organization as well.

for this project. They had opinions regarding the high stock levels of Meal Service and emphasized on the importance of getting a better knowledge about the profitability of the products. The supply planners did see examples of when the sales estimations were not met and forwarded this information to the sales function. There did, however, seem to be less communication regarding this issue backwards in the value chain, for example back to the category managers. The collaboration with the category managers is generally quite seldom. Two of the interviewees said that they neither communicate a lot with them nor do they see a need of it. Their contact with the sourcing team within Meal Service is also rather occasionally and happens mostly due to a specific problem. They do, however, have a lot more contact with the logistics team. Both to function as a link between the logistics and the sales to work cross-functionally in order to fulfill the customers' need, but also to work with the stock trends.

#### 5.1.3.2.2 Cost Elements & Drivers

There were some uncertainties about which parameters to see as cost elements and which to handle as cost drivers (see Table 13). The delivery reliability, i.e., could be seen as a cost if the delivery to customers is delayed and the customers are dissatisfied. However, it might also be seen as a driver of other costs such as storage cost and other warehousing cost (if the delivery reliability percentage is set very high and driving a lot of inventory). The first mentioned would then be output delivery reliability and the second promised delivery reliability, something that might not be clear for all parties. Similarly was discussed for lead-time, which can be looked upon as what the actual cost of long lead-time is or how the lead-time affects the costs in the supply chain, such as the freight cost, inventory cost (stock levels) etc.

Cost Elements	Cost Drivers
<ul style="list-style-type: none"> <li>• Cost of risks</li> <li>• Cost of delayed delivery to customers</li> <li>• Cost of long lead time</li> <li>• Warehousing cost</li> <li>• All costs before delivery to Duni warehouse</li> <li>• Freight</li> </ul>	<ul style="list-style-type: none"> <li>• Lead time</li> <li>• Delivery reliability</li> <li>• Customer service</li> <li>• Delivery performance by supplier</li> <li>• Safety stock</li> <li>• Incoterms</li> <li>• Discontinued articles</li> <li>• Truck load</li> <li>• Sales estimates (over-optimistic)</li> <li>• MOQ</li> <li>• Inventory turnover</li> <li>• Sales incentives</li> <li>• High stock levels</li> </ul>

Table 13. Cost elements and drivers mentioned by other Supply Chain function employees.

Furthermore it was discussed that discontinued articles and sales incentives might have a large impact on Duni's business. The current sales situation is that the sellers only have incentives to sell new products. This led to that the old and discontinued articles almost never gets sold and they stay in inventory for a long time driving stock levels and related costs. Furthermore there is no clear process for scrapping and the old articles drives cost for a time that currently is unknown, it is only certain that it might be for several years sometimes.

#### 5.1.3.2.3 Application

Three application areas were mentioned during these interviews. The first was that the sourcing team in their sourcing decisions and other decisions regarding suppliers and their contracts should use the model. Secondly the model should be able to fit the needs of the category managers, supporting them in their product assortment decisions and in the phase in/out processes. Finally the model should work as a cross-functional tool, integrating the various departments.

#### 5.1.3.2.4 Success Factors

An important success factor is the users' opinions about the usage, i.e. how to make the model persistent and the maintenance of the model should be prioritized in the development. This should assure that users really felt included in the development and thereby also motivated to use it.

Further, it is important to have one person responsible for the model to make the ownership of the model clear and to make sure that the model will not be forgotten after some months. This person can also make sure that the model is updated accordingly, something that needs to be done regularly.

#### 5.1.3.2.5 Performance Measurements

Forecast planning is one function of the supply planning. There are two KPIs used for performance measurements of the forecasting: *forecast errors* and *forecast bias*. Forecast errors are measured in mean absolute percentage error, MAPE<sup>21</sup>. The forecast bias, on the other hand, is only measuring the deviation between the forecast and the actual sales, with regard to if the forecasted volume was less or more than the sales volume. The forecast planner believed these were good KPIs but saw the value of looking at the two measurements for different reasons. For example, he thought forecast bias was a better measurement to look at when determining the safety stock. The performance measurements for safety stock was, the delivery performance out to customers, with a goal of 95%.

#### 5.1.3.3 Summary of Supply Chain Function Interviews

In the following section a short summary of the Supply Chain function interviews follows.

##### 5.1.3.3.1 General

- Other departments seem to lack knowledge about the true costs of logistics
- Follow-ups and comprehensive evaluations could improve the business
- There is a lack of communication and collaboration within the whole organization

##### 5.1.3.3.2 Cost Elements & Drivers

The focus regarding cost elements were connected to storage and warehouse costs. Furthermore most of the cost drivers were connected to these costs as well, affecting the warehouse costs in various ways. The cost elements and cost drivers are summarized in Table 14.

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<sup>21</sup> This percentage is calculated as the deviation between forecast and actual sales divided by sales. Furthermore they are using weighted MAPE, so that the high volume articles are outweighing the low volume articles.

Cost Elements	Cost Drivers
<ul style="list-style-type: none"> <li>• Scrapping cost</li> <li>• Freight (internal/inbound/outbound)</li> <li>• Palletizing</li> <li>• Storing cost (internal/external)</li> <li>• Inventory cost</li> <li>• Cost of quality issues</li> <li>• Warehouse cost (handling, administration, depreciation)</li> <li>• Packaging cost</li> <li>• Cost of keeping discontinued articles on stock</li> <li>• Customs duties</li> <li>• Currency risk</li> <li>• Tied up capital cost</li> </ul>	<ul style="list-style-type: none"> <li>• MOQ</li> <li>• MPQ</li> <li>• Truck load</li> <li>• Storage location</li> <li>• Obsolete/discontinued articles</li> <li>• Product type (seasonal or slow mover)</li> <li>• Stock levels (safety stocks)</li> <li>• Sales incentives</li> <li>• Lead time</li> <li>• Sales estimates</li> <li>• Incoterms</li> <li>• DOI - days of inventory</li> <li>• Delivery reliability</li> <li>• Inventory management</li> <li>• Warehousing performance (productivity/capacity)</li> <li>• Poor communication</li> <li>• Phase in/out</li> <li>• Commitments</li> <li>• Number of articles (complexity)</li> <li>• Scrapping process (limits)</li> <li>• Supplier location (Asia/Europe)</li> <li>• Inventory turnover</li> <li>• Pallet load (full/mixed)</li> <li>• Delivery performance by supplier</li> <li>• Customer service</li> <li>• Order structure</li> <li>• Payment terms</li> </ul>

Table 14. A summary of the cost elements and drivers mentioned in Supply Chain function interviews.

#### 5.1.3.3.3 Application

Application areas suggested by the Supply Chain function are:

- Usage by sourcing team and category managers, in sourcing and product assortment decisions
- Visualization of the true costs and bring transparency into the organization
- Support for decision-making
- Support integration of the Duni organization, especially between the Supply Chain function and Meal Service

#### 5.1.3.3.4 Success Factors

The key success factors when implementing and making the model sustainable can be summarized as follows:

- The users opinions should be guiding the development of the model
- There need to be one assigned person or role connected to the ownership of the model
- The model needs to be updated regularly with fresh information, and the updates should fit the schedule of the persons responsible for the input data
- True costs should be used in the model

### 5.1.3.3.5 Performance Measurements

The exact KPIs for measuring warehouse performance were not found out through the interviews with the logistics team. However, the recently developed measurements of the warehousing was aiming at improve the effectiveness within the warehouse. A summary of the KPIs for other parts of the Supply Chain department is listed below.

- Lead times met by forwarder (Schenker)
- Average truck load
- Forecast errors
- Forecast bias
- Delivery performance (out to customers)

### 5.1.4 Duni Group Controller Interviews

These interviews refer to two interviews with the Duni group controller (working centrally for all business areas). The outcome from these interviews will be presented in the sections below.

#### 5.1.4.1 General

The Duni group controller was supportive of this project and believed that a better transparency of the cost situation would help the sourcing team within Duni. But he also saw a value in how that would lead to a better overall understanding of the business for other departments as well.

#### 5.1.4.2 Cost Elements & Drivers

A lot of different cost elements were discussed as can be seen in Table 15. Regarding the cost drivers, it was discussed how the risk for currency exchange should be included since this might affect the decisions in the longer run. Especially since it might be that the currency factor that is used in calculations during a negotiation will make the total cost situation look very good then, but that factor might have changed a lot until the actual purchase will be done. Furthermore it was discussed how the loading of pallets out to customers will affect the resources (and then costs) that is needed. Statistics has shown that almost 50% of the outgoing pallets from the Bramsche warehouse are mixed pallets, which of course requires more handling resources than only shipping full pallets would do.

Cost Elements	Cost Drivers
<ul style="list-style-type: none"> <li>• Purchase price</li> <li>• Inbound freight</li> <li>• Customs duties</li> <li>• Warehousing cost</li> <li>• Outbound logistics (transport to customers)</li> <li>• Cost of customization – large customer involvement</li> <li>• Internal freight cost</li> <li>• Cost of tied up capital in warehouses</li> <li>• Cost of currency risk</li> <li>• Warehouse administration cost</li> <li>• Warehouse depreciation cost</li> </ul>	<ul style="list-style-type: none"> <li>• Risk for currency exchange</li> <li>• Inventory turnover</li> <li>• Pallet load (full or mix)</li> <li>• Lead time</li> <li>• DOI</li> </ul>

Table 15. Cost elements and drivers from the interviews with the group controller.

#### 5.1.4.3 *Application*

The application areas suggested are:

- Support the sourcing team with information effectively, quicker than today
- Show the holistic perspective of cost elements, with the true costs
- Give transparency
- Bring understanding for how the different departments affect Duni as a total, and how they affect each other

#### 5.1.4.4 *Success Factors*

As key success factors the following two factors were mentioned in the final interviews:

- It is important that the model is transparent
- The model should be simple, both in its appearance as well as in the usage of it

#### 5.1.4.5 *Performance Measurements*

No information regarding performance measurements was contained from these interviews.

### 5.1.5 Discussion of the Empirical Data

The following section discusses the findings from the five key areas of the interview study: general information, cost elements and drivers, application, success factors, and performance measurements. It will evaluate and elaborate on the information from the various interviews. Furthermore, it lead to a summary of the interview study and the empirical data. This was to clarify what empirical knowledge we gained from the interview study and what key findings that were drawn.

#### 5.1.5.1 *General*

Overall, we were met with a very positive attitude towards this master thesis study from all of the interviewees. We interpreted this as additional evidence of improvement potential regarding the cost situation at Duni and for the need of a cost analysis to be performed. There were a lot of support for this particular subject of a study and several of them emphasized the importance of this matter to be assessed properly. They saw a lot of applications for the information provided by a cost analysis and several usage areas for a cost model. Since some of the interviewees were outside of the Meal Service department, they saw other values of this project only than a part of the ongoing business development process within Meal Service.<sup>22</sup>

One of the background issues we found during the pre-study phase was regarding the communication and collaboration within Duni. This became even clearer during the interview study. Several of the interviewees described a lack of communication and what issues that resulted in. However, some of the supply planners did not always see the occasional communication as a problem, as it was with their contact with the category managers. What we could find then was, though, that the category managers experienced issues both with their communications to each other and also how they integrated with each other's work. To conclude, the majority of the respondents did mention a lack of communication and cooperation within the organization. We perceived it as this had, in turn, led to a lack of transparency and understanding for how the departments affected each other and thereby a lack of knowledge about the true costs of the products. The lack of transparency could also be the reason for few follow-ups and not having a proper process for the cost evaluations of the products.

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<sup>22</sup> The steering group did, however, emphasize the importance for us to stick to the determined scope since the study was big enough anyway, and because of the time frame we needed limitations.

#### 5.1.5.2 Cost Elements & Drivers

From the interviews it was clear that the knowledge about the whole supply chain and their costs was very limited within the different functions. The sourcing members had almost only knowledge about the costs in the initial phase of a product life-cycle, whereas the employees in the Supply Chain function mostly outlined costs connected to warehousing.

The cost drivers that were mentioned by the sourcing team was limited to drivers<sup>23</sup> that they could see themselves affect in the negotiation phase. The drivers mentioned in the Supply Chain interviews were more widely spread, but mostly driving costs in the warehouse.

However, when all the interviews are combined a rather good picture of cost elements and cost drivers throughout the supply chain appeared. It was also clear that the business controllers that were interviewed had the best overall holistic view of the costs and drivers of all the interviewees, something that is not very surprising due to their role in the company. Although they might not have succeeded totally in the transfer of this information to the other employees, not even to the once within the same department.

The findings about cost elements are summarized in Table 16. The table shows, with a cross mark, if a cost element was mentioned by any of the respondents within each of the groups, as the interviews are presented above. A small cross mark is used when the interviewees mentioned an overall cost category where this particular cost element can be seen as a part of. Warehousing cost, for example, was mentioned by several of the respondents on a more or less detailed level. Some of them broke it down into further cost elements, such as handling, storing, administration and depreciation cost, while others did not. In the table below we have summarized it into warehousing cost (including handling, administration and depreciation cost) and storing cost (both internal and external), thereby the small cross marks for storing cost.

Some cost elements were mentioned in almost all of the interviews, such as purchase price, freight cost, warehousing cost, scrapping cost and customs duties. These might be considered as some of the most obvious costs in the product flow and it was therefore quite expected that the interviewees should have knowledge about these costs. However, it was clear that they did not know a lot about them, like how big the costs were or what impact they had on the total cost of a product.

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<sup>23</sup> It can be discussed which of the suggested cost drivers that actually are drivers and which that should be considered as costs themselves. Delivery performance and lead-time are two examples and it all depends on how you look upon it. Nevertheless, we tried to make the distinction clear during the interviews to make sure that the interviewees understood our definition of the different concepts cost elements and cost drivers. But since we had some struggles to clarify the definitions and that the reality is not black or white only, it was no surprise that this phenomena occurred during the interviews as well.

Cost Elements							
	Meal Service			Supply Chain		Group controller	Selected
	Sourcing team	Category managers	Director & controller	Bramsche	Malmö		
Customization cost	X					X	X
Cost for repacking due to damages	X						X
Purchase price	X	X	X		x	X	X
Palletizing cost	X			X	x		X
Safety stock at supplier	X						
Freight cost (inbound/outbound/internal)	X	X	X	X	X	X	X
Quality issues	X			X			X
Warehouse cost (handling, administration, depreciation)	X		X	X	X	X	X
Storing cost (internal/external)	x		x	X	x	x	X
Inventory cost	X				X		
Scrapping cost	X	X	X	X			X
Customs duties			X	X	x	X	X
Packaging cost			X	X	x		X
Currency risk				X	x	X	X
Tied up capital cost				X		X	X
Cost of keeping discontinued articles on stock				X			X
Cost of delayed delivery to customers					X		
Cost of long lead time					X		

Table 16. A summary of the cost elements mentioned during the empirical data collection.

In the column to the right are the cost elements that we selected to continue with in the further study. Due to the time limitation, we decided to not select the once that only got one cross mark, except for the cost of repacking due to damages, since that is related to the cost of quality issues. The same goes for cost of keeping discontinued articles on stock, since that is related to the scrapping process and also the cost elements regarding warehousing, storing and tied up capital. The three latter once are also the reason why the inventory cost were not selected. These are together covering the meaning of inventory cost.

The cost drivers from all of the interviews are presented in Table 17. The cross marks work in the same way here and the column to the right shows which of the cost drivers that were selected for the further assessed in the analysis phase. All of the cost drivers that were not selected were only mentioned within one of the interview groups.

Cost Drivers							
	Meal Service			Supply Chain		Group controller	Selected
	Sourcing team	Category managers	Director & controller	Bramsche	Malmö		
MOQ	X			X	X		X
Re-packing/handling at port			X				X
MPQ	X			X			X
Material and printing for purchase price	X						
Currency	X					X	X
Payment terms	X		X	X			X
Order structure			x	X	x		X
Lead time	X			X	X	X	X
Supplier capability (tools/production/lamination)	X						
Phase in/out		X	X	X			X
Product type		X		X			X
Market demand/price		X					
Warehouse and safety stock location			X	X	x		X
Number of articles		X		X			X
Delivery performance by supplier			X	x	X		X
Incoterms			X	X	X		X
Truck load				X	X		X
Sales estimates				X	X		X
DOI - days of inventory				X		X	X
Commitments			X	X			X
Supplier location (Asia/Europe)				X			X
Poor communication				X			X
Sales incentives				X	X		X
Inventory management				X			
Stock levels (safety stocks)				X	X		X
Obsolete/discontinued articles				X	X		X
Warehousing performance (productivity/capacity)				X			X
Delivery reliability				X	X		X
Inventory turnover					X	X	X
Scrapping process (limits)				X			X
Pallet load (full/mixed)				X		X	X
Customer service				X	X		X

Table 17. A summary of the cost drivers mentioned during the empirical data collection.

### 5.1.5.3 Application

The expectations of the cost model's applicability seems consistent throughout the organization, see Table 18, which shows that the decision of this project was thought through and aligned through more than one part of Duni. It was clear that the users should be the sourcing team and the category managers, and that everyone was aware of this. It was also clear that the expectations on the model were that it should show a holistic view of the true costs to give transparency about the cost situation.

Furthermore, it seemed like everyone agreed that that the model hopefully could help to integrate the different functions, especially Meal Service and the Supply Chain function, and to help bring cross-functionality into the organization. Time will tell whether only a cost model will help. But the fact that people already have started to talk more to each other over department boundaries, and that they are aware that a further collaboration is needed, is a huge step in the right direction. Hopefully the model can be helpful in the communication between functions and that it will bring gained understanding of how the decisions in one department might affect another department as well.

Applications							
	Meal Service			Supply Chain		Group controller	Selected
	Sourcing team	Category managers	Director & controller	Bramsche	Malmö		
Supplier selection decisions	X				X		X
Support sourcing decisions			X		X		X
Support phase in/out decisions	X	X			X		X
Show the true costs	X	X		X		X	X
Visualization of potential trade-offs	X		X	X			X
Holistic view of the cost situation	X	X	X	X		X	X
Bring transparency/visibility	X	X		X		X	X
To increase cross-functional work	X			X	X		X
Highlight potential cost savings	X	X	X				X
Provide cost information effectively and quicker than today			X			X	X
Knowledge for how the departments affect each other and the whole organization			x	X	x	X	X

Table 18. A summary of the applications mentioned during the empirical data collection.

### 5.1.5.4 Success Factors

Even the success factors mentioned by the interviewees were quite consistent which is shown in Table 19. However, some of the interviewees focused more on the appearance of the model, while others emphasized on how to maintain the model. Some of them did also give suggestions on what to consider during the cost analysis and what to include in the model development.

Simplicity and user friendly were mentioned as success factors by almost all of the persons and hence important to take into consideration in the development. For Duni, and Meal Service, the focus is on getting a good picture of how the cost flow looks like. Even if some costs need to be left out of the model it is better to involve the largest and most important costs in the first development. Further costs can be involved in a later stage when there is more time to do an even deeper and detailed investigation.

Success factors							
	Meal Service			Supply Chain		Group controller	Selected
	Sourcing team	Category managers	Director & controller	Bramsche	Malmö		
Simple in its appearance	X	X	x			X	X
Easy to use	X	X				X	X
Easy to understand	X	x				x	X
Show graphical views	X						X
Localized/Work offline	X						X
Emphasize the user opinions			x		X		X
Start develop on a small/basic scale		X	X				X
Emphasize cost elements with significant contribution		X	X				X
Emphasize cost elements affected by the sourcing team			X		x		X
Calculate with true costs				X		x	X
Assign an owner role, responsible for the model				X	X		X
Update the model regularly				X	X		X

Table 19. A summary of the success factors mentioned during the empirical data collection.

Another mentioned success factor was the usage of true costs. The way of not invoicing the business areas with all the logistic costs is a chosen way to do it at Duni and something that will not possibly change in the nearest future. However, in our model we should use the true costs as input to the model so that Meal Service will get the real picture instead of the adjusted numbers. It was also clear during the Meal Service interviews that the number that they use today as an estimate of the warehousing cost was a lot lower than the actual cost that we got from the logistics business controller<sup>24</sup>. So this model will definitely help them gain a better understanding of the true costs.

Furthermore it was mentioned that the user's opinion of the model construction should be prioritized. This seems to be very smart since it is important that the users feel motivated to use the model. It can be easy for managers to see a great potential with a new tool, but if no one will use the model the development of it will be worthless. Therefore opinions such as that the model should be able to use offline, and that it should be easy to use and understand, are extra important to consider.

#### 5.1.5.5 Performance Measurements

KPIs are today used as performance measurements in several departments of Duni, which however seem to be a pretty new development. Some of the KPIs were rather new and several of the interviewees told us that they had none or only a few KPIs until recently. The attitude towards some of the measurements, and also the whole use of KPI, seemed to vary. Some of the respondents saw a great value in the use of KPIs for the business development, both within their own department but also for Duni as a whole. Others were a bit more skeptical towards the KPIs, though mostly was because they thought the KPIs were difficult to measure or did not measure what was important. We could therefore also see tendencies to a lack of full knowledge about what KPIs they measured and the purpose of them. This was even more obvious regarding knowledge about what KPIs other department had, and even between different areas

<sup>24</sup> An insight gained during the comparison of the interviews with the sourcing team and the business controller for logistics.

within the same department as shown in Table 20. Overall, there seemed to be some lack of understanding for what and why the different KPIs were measured.

Performance measurements							
	Meal Service			Supply Chain		Group controller	Selected
	Sourcing team	Category managers	Director & controller	Bramsche	Malmö		
Cost savings	X		X				X
Delivery reliability (from supplier)	X						X
Contracted spend	X						X
Raw material clause coverage	X						X
Residual value		X					X
Top line growth		X					X
CB1		X					X
Number of articles in the assortment			X				X
Lead times met by forwarder (Schenker)				X			X
Average truck load				X			X
Forecast errors					X		X
Forecast bias					X		X
Delivery performance (out to customer)					X		X
Warehouse performance				X			X

Table 20. A summary of the KPIs mentioned during the empirical data collection.

### 5.1.6 Synopsis of the Empirical Data

In this section a short summary of the chapter is presented with the key takeaways from each of the focus areas within the interview study. This summary together with some of the discussions above should then work as an input to the analysis in the next chapter.

#### 5.1.6.1 General

The general aspects from the different interviews can be summarized and concluded as the following:

- Positive attitude towards this master thesis study and what result this project can provide them with
- Part of the ongoing business development process within Meal Service
- There is a need for aligning the different work functions and strive towards a common goal
- The communication within Meal Service is working well but there is potential for improvements
- There is a lack of collaboration between Meal Service and functions within the Supply Chain department, especially the logistics team
- There is a need for better and more regularly communication between Meal Service and the Supply Chain department
- There is a lack of knowledge about the true costs of logistics
- Follow-ups and comprehensive evaluations could improve the business

### 5.1.6.2 Cost Elements & Drivers

The key cost elements and cost drivers to take from the empirical data chapter and into the analysis chapter are condensed in Table 21. Some of the elements and drivers mentioned in the interviews were interpreted to be the same, and therefore put together in the summary.

Cost Elements	Cost Drivers
<ul style="list-style-type: none"> <li>• Customization cost</li> <li>• Cost for repacking due to damages</li> <li>• Purchase price</li> <li>• Palletizing cost</li> <li>• Freight cost (inbound/outbound/internal)</li> <li>• Quality issues</li> <li>• Warehouse cost (handling, administration, depreciation)</li> <li>• Storing cost (internal/external)</li> <li>• Scrapping cost</li> <li>• Customs duties</li> <li>• Packaging cost</li> <li>• Currency risk</li> <li>• Tied up capital cost</li> <li>• Cost of keeping discontinued articles on stock</li> </ul>	<ul style="list-style-type: none"> <li>• MOQ</li> <li>• Re-packing/handling at port</li> <li>• MPQ</li> <li>• Currency</li> <li>• Payment terms</li> <li>• Lead time</li> <li>• Phase in/out</li> <li>• Product type</li> <li>• Warehouse and safety stock location</li> <li>• Number of articles</li> <li>• Delivery performance from supplier</li> <li>• Incoterms</li> <li>• Truck load</li> <li>• Sales estimates</li> <li>• DOI - days of inventory</li> <li>• Commitments</li> <li>• Supplier location (Asia/Europe)</li> <li>• Poor communication</li> <li>• Sales incentives</li> <li>• Stock levels (safety stocks)</li> <li>• Discontinued/obsolete articles</li> <li>• Warehousing performance (productivity/capacity)</li> <li>• Delivery reliability</li> <li>• Inventory turnover</li> <li>• Scrapping process (limits)</li> <li>• Pallet load (full/mixed)</li> <li>• Customer service</li> </ul>

Table 21. Summary of cost elements and cost drivers.

### 5.1.6.3 Application

The suggestions and requests of the applicability of the model from the empirical chapter can be summarized as the following ones:

- The head users of the model should be the sourcing team and the category managers
- The model should be used as a support in sourcing and assortment decision making
- The model should show a holistic view of the true costs related to products
- The model should visualize potential trade-offs
- The model should bring transparency and highlight potential cost savings
- The model should provide cost information effectively and quicker than today

- Through the usage of the cost model it should be easier for the Supply Chain function and for Meal Service to work cross-functional

These parameters should be taken into consideration in the development of the model and will be analyzed further in chapter six.

#### 5.1.6.4 *Success Factors*

Finally, the success factors suggested by the Duni employees to take into consideration when implementing and making the model sustainable are:

- The model should be simple in its appearance
- The model should be easy to use and to understand
- The model should show graphical views
- The users should be able to use the model offline by having it localized at the users computers
- The users opinions should be of guidance in the development of the model
- The development should start on a small and basic scale
- Emphasize on including cost elements with a significant contribution to the total cost but also cost elements that can be affected by the sourcing team
- Calculate with true costs
- There need to be one assigned person or role connected to the ownership of the model
- The model should be updated regularly with sufficient input data

#### 5.1.6.5 *Performance Measurements*

The different KPIs that were mentioned throughout the interviews are listed below. There were various opinions regarding the use and purpose of some of these. Another key takeaway from this area is the mixed attitude towards performance measurements and how they are working with this at Duni.

- Cost savings
- Delivery reliability (from supplier)
- Contracted spend
- Raw material clause coverage
- Residual value
- Top line growth
- CB1
- Number of articles in the assortment
- Lead times met by forwarder (Schenker)
- Average truck load
- Forecast errors
- Forecast bias
- Delivery performance (out to customers)
- Warehouse performance

## 6 Analysis & Findings

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*The analysis part of the study was the start of developing the construction. However, due to the extensive information in this section the analysis part is a chapter of its own, followed by the construction chapter. This chapter includes the analysis based on information from the theoretical framework and the empirical data. The first analysis is made on more general information. The second analysis is on the cost elements and drivers. Thirdly an analysis of the application areas of the cost model is done followed by the key success factors. Finally the performance measurements will be analyzed and the chapter is concluded with the overall findings made from these analyses.*

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The comparing and discussing of the similarities and differences between the theoretical framework and the empirical data makes the analysis in this chapter. The purpose is to decide what parameters to use in the development of the cost model and also what recommendations to give to Duni about the application and the success factors regarding the model. Furthermore some general issues will be discussed and analyzed, something that might affect the model's context and thereby also affect the usage of it. The analysis will be made on the following areas:

- General issues at Duni
- Cost elements and drivers
- Application
- Success factors
- Performance measurements

This analysis will also be of importance when answering the research questions later on in this thesis. The overall RQ and the supporting RQ1 and RQ2 are stated below.

RQ: How to successfully develop and implement a suitable purchasing cost model at Duni?

RQ1: Which are the relevant cost elements and cost drivers to take into consideration when doing sourcing and economic life cycle decisions at Duni Meal Service?

RQ2: Which are the key critical success factors according to literature in order to successfully implement a purchasing cost model?

As has been mentioned before, cost elements and cost drivers are mainly connected to RQ1 whereas application and success factors are connected to RQ2. Furthermore general issues at Duni and performance measurements are more connected to the overall RQ and to some of the underlying problems at Duni mentioned in the background of this thesis.

### 6.1 General Analysis

Theory recommended cross-functionally work, within an organization, as crucial to get a successful purchasing function. At Duni this is however not the case, especially not between the sourcing team and functions such as sales and the Supply Chain function. The sourcing team has a good collaboration with the category managers within the Meal Service business area but that is as far as the cooperation goes. A better relation with the Supply Chain function i.e. would not only lead to a higher understanding of how their work might impact the rest of the business. They would also increase the possibility of getting useful help in decision-making when trying to optimize the whole supply chain. Furthermore, it was clear during our interviews that the sourcing team had a very limited knowledge and understanding of the logistic costs, costs that we easily got information about only by asking one person. Hence, the problem was not the lack of information; instead it is the lack of communication and awareness of who to talk to within the organization. By increasing the cross-functional work within Duni the step to go and ask someone a simple question would be much shorter. The use of a purchasing cost model could even provide them with information without needing to ask someone. Moreover, this would also motivate the sourcing team to take decisions affecting the whole supply chain in a positive way instead of only focusing on getting the lowest price as it is today.

As this goes outside what the sourcing team could fix themselves, it is important that the overall Duni business strategy supports and encourage cross-functional integration within the whole organization. Although, it is extra important to have a good collaboration between Meal Service and the sales and Supply Chain functions since those processes are value-added for a trade business, which Meal Service mostly is. It is those processes that will make sure that Meal Service, and the traded goods, fulfill their purpose.

Additionally, as written in section 4.6.1.1 *Purchasing Management*, the sourcing team should make sure that they focus on their core tasks and responsibilities in order to have a well-working purchasing function. The thesis has not focused a lot on this, but since a good purchasing function will increase the likelihood of a successful usage of the cost model this is still seen as a factor that is important to take into account. Therefore these core tasks will be briefly analyzed in this section to give an indication of things that the sourcing team can focus more on in the future.

According to van Weele (2014), and described in section 4.2.4 *Primary Tasks and Responsibility*, the key purchasing function tasks are the following: Operational excellence, cost control, risk management and continuous improvements. Regarding operational excellence it would be beneficial for Duni if the collaboration between the supply planning function, sales and the sourcing team were increased. They could then make sure that supply would be secured timely without affecting the costs in a negative way. Moreover, considering the cost control, this is something that the sourcing team of Meal Service seems to focus a lot on. They are currently looking into potential ways of saving money related to purchasing spend, and the request of the cost model also shows this. Risk management seems to be something that the sourcing team have started to think about recently. In example, currency risk was wanted to be considered in the cost model since Duni had noticed historical contracts with supplier where no risk consideration was taken, resulting in greater expense for them today. Besides this, they do not seem to focus a lot on looking at potential risks, and they could be able to work more with this. Especially since they source a lot of their products from Asia, and theft during freight or damaged goods might be costly risks.

Regarding the continuous improvement responsibilities, Meal Service do not seem to have very many partnerships with their suppliers. This could be extended, and based on the information in section 4.2.4.4 *Continuous Improvement*, one suggestion for Meal Service is to increase the collaboration for customization projects. However, they are currently trying to analyze their suppliers to see whom they can work without and who to potentially increase the supply from. This might be one step in that direction.

## 6.2 Cost Elements & Drivers Analysis

There were not a clear distinction between cost elements and cost drivers all the time in the literature. The four studied cost models were not constructed based on cost elements and cost drivers the way we intended to look at the problem, so it was sometimes a bit difficult to get a clear overview of the structure of the models. The difference between cost elements and drivers were also a bit unclear among the interviewees. They could, for example, answer a question regarding pure costs with what factors that drove the cost to occur instead. Though, this was a minor problem here since it was easier for us to follow what the respondents meant. We have, however, made findings regarding both cost elements and cost drivers within the studied theory as well as in the interview study, i.e. within Duni and especially regarding Meal Service.

### 6.2.1 The Four Studied Cost Models

From the theoretical framework of the four studied cost models, found under section 4.4 *Cost Management*, we made findings regarding how the scope of the cost analysis differed between the cost models. The directive for the cost analysis in this project, contradict the thoughts behind a TCO and a LCC, where the

cost analysis should cover the whole process of a product's life time. The scope<sup>25</sup> of this study is between when Duni is taking over the ownership of the products and right before the products leave Duni warehouse to be transported out to customers. Since this leaves out some of the cost elements connected to the products it will also leave out some of the activities done, and is therefore different from an ABC analysis where all of the activities within a process should be sought for and later on linked to a certain product when possible, regardless of where along a product's life cycle the activity occurred. The landed cost is the model that matches the scope of this study the best. However, the transactional phase does include the freight to customers, which differs from the scope of our study. The reflection regarding the scope of the cost analysis is however that it is expandable in a future project.

### 6.2.2 Standard vs. Unique Cost Model

Another difference between the theoretical framework and the empirical findings is how the uniqueness of products and specific situations are considered within the cost analysis. There was not a lot of focus on these types of characteristics from the respondents. A lot of them focused on general cost elements that occur for all of the products in the assortment. It seemed difficult to get a hold on cost elements, only connected to a particular kind of product. However, we did make findings of some of these cost elements, such as the cost of currency risk, customs duties and customization cost. Regarding the cost drivers, one of them was identified as product type, meaning that the uniqueness of a certain product type could have an effect on the total cost of purchasing for that product. Some of the other cost drivers found through the interviews, might also be affected by the product type and therefore, in turn, drive the cost in different directions.

The question about a standard or unique cost model seems to be affected by the above mentioned. The need for several unique cost models is not suggested by anyone. The relatively low number of unique cost elements does also indicate that there is no such need. It might be able to include those cost elements in the same model anyway, and still keep it simple as was requested from the majority of the respondents. It might however be more difficult to include how some of the cost elements are driven differently depending on unique cost drivers. Consequently that the simplicity is lost due to different calculations for the same cost elements depending on product type or a specific situation. That implies the need for multiple cost models, and we certainly do understand what the literature was trying to point out with this better now. Yet, we do see the time frame as an obstacle for us to be able to create several unique cost models; especially since Meal Service have around 1500 different products in their assortment. Since the study only includes traded goods and disposables, some uniqueness and contextual aspects are, however, already included and considered from the start.

### 6.2.3 Cost Elements

The majority of the respondents seemed to spontaneously think of the cost elements that they believed were the most significant when answering our questions. They also seemed to focus on the most obvious cost drivers. This is in line with the theoretical aspects. Several of the studied cost models urge to put emphasize on cost elements and drivers that had a significant contribution to the total cost. Though, the exact amount of contribution is not yet calculated but when several sources from Duni states the same cost elements as important we surely should take it into consideration.

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<sup>25</sup> The decisions regarding the scope of the cost analysis were taken in agreement with the steering group. The aim from the steering group seemed to be to focus the study right from the start and make sure that we included the cost elements that they intended to get an analysis of. Since they were all well aware of the time limitations for this project we believe that they tried to focus the study around what would be most beneficial for the sourcing team since they were the main users of the cost model that were to be developed.

### 6.2.3.1 Categorization

Regarding the categorization of cost elements, we tried to investigate what each of the interviewees actually meant with the costs they proposed.<sup>26</sup> Sometimes when we investigated the question a bit further we also found out that the cost element could be broken down into several cost elements. This was for example the case when someone mentioned the warehousing cost. This cost category included several other cost elements, such as storage cost and handling cost and could instead be divided into these cost elements. However, some of the interviewees seemed to be unaware of what cost elements that were actually connected to the warehousing cost, and looked at it as a total cost. To better understand what drives the different cost to incur we thought it was important for us to break down the cost categories whenever possible. This was also due to the importance of how the measurement and calculations of these costs would be affected by the categorization of them, as emphasized in the theory.

### 6.2.3.2 Similarities with the Theoretical Framework

The cost elements identified in the empirical study are almost all mentioned in the theory as well as can be seen in Table 22. The cost for warehousing, the different freight costs and storage cost that are findings from the interview study are in some way mentioned in the studied literature for each of the four cost models. In some cases they were mentioned in the same way as above or referred to as logistics or transport cost. The warehouse administration and depreciation cost was mentioned in the interview study as a breakdown of the more holistic cost category warehouse cost. We could therefore see a connection also between these two cost elements and the cost category logistics cost mentioned in the theoretical framework. Different kind of administration costs were also mentioned as cost elements within several of the studied cost models. Other similar costs between the theory and the empirical findings are the purchase price for a product, cost of quality issues and customs duties.

Cost Elements	
Empirical findings	Theoretical findings
<ul style="list-style-type: none"> <li>• Warehouse cost (handling, administration, depreciation)</li> <li>• Storing cost (internal/external)</li> <li>• Freight cost (inbound/outbound/internal)</li> <li>• Purchase price</li> <li>• Quality issues</li> <li>• Customs duties</li> <li>• Tied up capital cost</li> <li>• Cost of keeping discontinued articles on stock</li> <li>• Scrapping cost</li> <li>• Currency risk</li> <li>• Cost for repacking due to damages</li> <li>• Customization cost</li> <li>• Packaging cost</li> <li>• Palletizing cost</li> </ul>	<ul style="list-style-type: none"> <li>• Logistics</li> <li>• Transport</li> <li>• Administration</li> <li>• Overhead</li> <li>• Initial price</li> <li>• Quality</li> <li>• Customs</li> <li>• Inventory</li> <li>• Ownership</li> <li>• Risk</li> <li>• Marketing and sales</li> <li>• Transaction</li> <li>• Operations</li> <li>• Service</li> <li>• Engineering and development</li> <li>• Supplier Reliability and Capability</li> </ul>

Table 22. Comparing the cost elements found in the empirical study with the once from the theoretical framework.

<sup>26</sup> We wanted the respondents to describe how the cost occurred and thereby connect it to possible cost drivers. This was also a way of getting deeper knowledge of what exact cost element the respondent was pointing out. It could be that different persons used the same term even though they were referring to different cost elements and we wanted to minimize the risk of those misunderstandings.

### 6.2.3.3 *Tied Up Capital or Scrapping*

The cost of tied up capital in inventory were mentioned in the interviews, and were distinguished from the storage cost, which referred to other costs regarding stock keeping than the tied up capital. This is related to some of the cost elements mentioned in the theory, such as inventory cost or cost of ownership. Related to this, was also the cost of keeping discontinued articles on stock mentioned. This is probably because Duni have a bit of problems regarding discontinued goods and obsolete articles. The problem seems to be the eventually scrapping of these articles. There is no proper process for what and when to scrap stock keeping goods. There is also a lack of knowledge about who is actually responsible for the scrapping process and Duni does not seem to have proper guidelines regarding the procedure of this. This has led to a lack of responsibility for this problem, misunderstandings and avoidance of taking care of the scrapping process. In turn, they now have a continuously growing stock level for discontinued and obsolete articles in their warehouse. Some of the respondents mentioned the cost for scrapping goods but we believe that it is important to also consider the cost of keeping the articles on stock since this seems to be what often happens at Duni. To keep discontinued and obsolete articles on stock for a very long time could also be viewed as a cost driver itself, and not only as storage cost and a cost for tied up capital. The occupied pallet places and the high stock levels that it contributes to could drive costs such as investment in a new warehouse or rental cost for keeping goods in external warehouses instead.

### 6.2.3.4 *Differences with the Theoretical Framework*

There were not a lot of risk factors mentioned in the interviews, except from the currency risk. For some of the respondents the cost of the currency risk seemed to be of high importance to include in the cost model. The cost for re-packing goods could, however, be seen as some sort of cost of risk. The re-packing cost was mentioned as a quality or handling issue with the packaging. This was not directly found as a cost element in the theory but cost drivers regarding delivery agreement and the reliability of supplier or carrier as well as material handling and perishability could be drivers for the re-packing cost.

None of the cost of customization, packaging cost and palletizing cost were mentioned as cost elements in the theory. However, these could also be connected to some of the mentioned cost drivers in the theory. Packaging is mentioned as a potential cost driver and material handling, location of supplier relative to the purchasing organization as well as delivery arrangement could also have an effect on the palletizing cost. Customization cost could be connected to cost drivers such as customer specifications, indirect labor and product complexity.

## 6.2.4 Cost Drivers

When comparing the cost drivers found in the empirical study with the suggested ones from the theory, there are a lot of similarities here as well. Lead time, product type, number of articles, location of the supplier, inventory turnover, scrapping process, payment terms and supplier capability are all mentioned both among the interviews and in the theory. Delivery performance from the supplier, risk with currency exchange, handling at port, storage location, warehousing performance, stock levels, safety stock and days of inventory (DOI) are identified as cost drivers within Duni. These are not expressed exactly like this in the theory, however there are a lot of cost drivers from the theory that are related to these ones. Other cost drivers at Duni such as minimum order quantity (MOQ), minimum production quantity (MPQ), **incoterms** and commitments could be perceived as agreement with the supplier and also connected to other cost drivers suggested in the theory, such as type of purchasing contract and degree of cooperation between the purchasing organization and the supplier.

Cost drivers such as sales estimates, sales incentives, different market demand and market price are cost drivers mentioned more specifically at Duni. This was also poor communication, pallet load (full or mix), delivery reliability to customers, obsolete and discontinued articles and phase in or phase out of products which were mentioned in the interviews as cost drivers at Duni. Even though they were not clearly found as cost drivers in the theory, none of them seem to be directly contradicting to the theoretical framework.

What was not found in theory nor directly mentioned in the interviews were how the KPIs can affect the cost situation. We found out that the KPIs are connected to the bonus system for the employees, affecting their way of working and also what decisions they make. We therefore see this as an additional cost driver at Duni. Another cost driver that was not directly mentioned by the interviewees are product quality. In the theory regarding TCO, the suitability for intended use was suggested as a cost driver. This was also product complexity, quality improvement, design obsolescence and customer specifications, see Figure 14 and Table 1 in section 4.4.1.2 *Cost Elements & Drivers*, and we summarize all of these as an additional cost driver named quality. What is also mentioned as a cost driver in Figure 14 is forecast uncertainty. This was not directly mentioned by any of the interviewees but we consider this as a cost driver to take into consideration for the further study anyway. This, since the forecast planning is based on the sales estimations, which was mentioned in several of the interviews. The forecast planning is also linked to other cost drivers such as MOQ, order structure, lead time and stock levels.

### 6.2.5 Conclusion

When comparing the cost elements and cost drivers found in the empirical study with the suggested ones from the theory, there is nothing that was especially surprising. Some of the cost elements and drivers at Duni were mentioned in the exact same way in the literature. Some others were a bit more specific to Duni but could easily be connected to an overall cost category mentioned in the theory, or linked to some of the cost drivers. All of the cost elements and cost drivers suggested in the theory are on the other hand not covered by the findings in the interview study. This is not very surprising due to the scope of this study, which leaves out some of the cost elements from the beginning and end of a product's life cycle, and thereby some cost drivers as well. Another factor is also that the theory considers manufacturing companies while the part of Duni that is including in this study is only dealing with traded goods.

The scope of this study does imply that even some of the cost elements identified at Duni should be left out of the further research. As already mentioned, the scope was set in an early stage of the project, mostly due to the time limitation. It was determined that the focus regarding cost elements should be within the scope. This would leave out customization cost and outbound freight cost. The first one, customization, was not provided as a cost element in the theoretical knowledge but could be of significance to Duni anyway. This might therefore be a cost element to include in a cost analysis at Duni in the future. The outbound freight is also something that should be included in a future cost analysis. This cost element is mentioned both in the theory and among the respondents of the interview study. However, the cost for outbound freight is probably easier for anyone at Duni to get a hold on compared to the customization cost. If we can develop a well-functioning cost model at Duni, this cost element will hopefully not be too hard to implement in the model as a further extension of it.

### 6.3 Application Analysis

Regarding the application areas suggested in the theory compared to the requests from the interviewees, there are similarities as well as differences shown in Table 23. A lot of the suggested application areas for the four studied cost models are connected to the suppliers, such as supplier selection, supplier evaluation and supplier development. In Duni's case these are not seen as the key usage areas. It has been discussed that the model could be used when selecting a supplier by comparing different alternatives in the model. Especially when comparing different suppliers within Asia or within Europe when the purchase price might be similar and the other cost parameters might have various impacts on the total cost. However, since Meal Service does not work very closely with their suppliers they do not see supplier development and supplier evaluation as model usage areas; at least not this first version of it.

Applications	
Empirical findings	Theoretical findings
<ul style="list-style-type: none"> <li>• The head users of the model should be the sourcing team and the category managers</li> <li>• Support in sourcing and assortment decision making</li> <li>• Show a holistic view of the true costs related to products</li> <li>• The model should visualize potential trade-offs</li> <li>• Bring transparency and highlight potential cost savings</li> <li>• The model should provide cost information effectively and quicker than today</li> <li>• Through the usage of the cost model it should be easier for the Supply Chain function and for Meal Service to work cross-functional</li> </ul>	<ul style="list-style-type: none"> <li>• To support different kind of sourcing decisions</li> <li>• Supplier selection</li> <li>• Supplier development</li> <li>• Supplier evaluation</li> <li>• Performance measurement</li> <li>• Other usage areas due to the providence of cost information</li> </ul>

Table 23. Comparing the applications found in the empirical study with the once from the theoretical framework.

Furthermore, an area that seems to be aligned between the theory and empirical data is the usage of the cost model as support in different kinds of sourcing decisions. By having a tool that many functions within Duni have been involved in developing and thereby trusts, results can be used as arguments and everyone knows where the results come from. It is also easier for the sourcing team to motivate some of their decisions if the results are taken from a model showing the real costs instead of estimated values that are used today. Moreover, it has been discussed at Duni that they have way too many articles in their product assortment today. However, no drastically reductions are planned. This might be a potential application area for the cost model: To go through the product assortment with help from the model and thereby identify which products that make the least profit and then be able to easily motivate the reductions of some articles supported by the model.

It is described in section 4.4.5.2 *Application* how several usage areas will come naturally only because of the providence of cost information that did not earlier exist. This was also discussed in many of the interviews; how the holistic view of the true product costs would give several usage areas and that this would make the collaboration between different functions easier. As one of these usage areas, the model should according to theory be able to provide information about both the cost and the risk situation and could then be used to identify cost saving potentials in the supply chain and how to prioritize them. Even this is in line with the ideas at Duni and it will suit their focus on finding cost savings very good.

It is suggested for both TCO and ABC, see Table 5 in section 4.4.5.2 *Application* how the cost models might be used as a foundation for performance measurements both towards suppliers and internally. However, due to the fact that Duni do not have that kind of relationship with their suppliers today, and that their current performance measurements might need to be evaluated and changed (as will be recommended later in this thesis), this will not be a prioritized usage area in the development of the Duni specific cost model. However, it can be good to have in mind in the future usage of the model. Especially if the model will be further developed then it might be a potential usage area to aim for.

To conclude, even if the desired application areas from the interviews and theory were somewhat alike, there were no specific theoretical model that totally suited the Duni needs. However, the theoretical framework can nevertheless work as a foundation for the further cost model development and the application areas, suggested for the four studied cost models, might be an aspect for future expansion of the cost model.

## 6.4 Success Factors Analysis

Regarding the success factors for the cost analysis and for the development, implementation, usage and maintenance of the cost model it seems important to prioritize those mentioned by the interviewees, and especially the future users of the model. This to make sure that they actually will use the model. As discussed in section 4.4.5.3 *Success Factors*, the success with cost analysis and cost model development seems to be depending on just the empirical data collection process. It was also mentioned in theory of LCC, see section 4.4.4.4 *Success Factors*, that some of the developers preferably should be employed within the organization, something that will not be the case in this thesis. Although, this also implies that the factors gathered during the empirical data collection should be of high value in the development. However, success factors mentioned in theory is also essential to consider since there might have been lessons learned in historical developments and usages of similar models. The findings from both the empirical study and the theoretical framework are presented in Table 24 below.

Success factors	
Empirical findings	Theoretical findings
<ul style="list-style-type: none"> <li>• The model should be simple in its appearance</li> <li>• The model should be easy to use and to understand</li> <li>• The model should show graphical views</li> <li>• The users should be able to use the model offline by having it localized at the users computers</li> <li>• The users opinions should be of guidance in the development of the model</li> <li>• The development should start on a small and basic scale</li> <li>• Emphasize cost elements with a significant contribution to the total cost but also cost elements that can be affected by the sourcing team</li> <li>• Calculate with true costs</li> <li>• There need to be one assigned person or role connected to the ownership of the model</li> <li>• The model should be updated regularly with sufficient input data</li> </ul>	<ul style="list-style-type: none"> <li>• The importance of the empirical data collection</li> <li>• Cover a broad range of information sources</li> <li>• Consider the uniqueness of products and situations within the cost analysis</li> <li>• Emphasize cost elements and drivers with significant contribution</li> <li>• Consider standard vs. unique cost model</li> <li>• Assess whether any of the studied cost models are suitable for this project and the studied system</li> <li>• The time frame</li> <li>• Basically correct is good enough</li> <li>• Top management support</li> </ul>

Table 24. Comparing the success factors found in the empirical study with the once from the theoretical framework.

The most frequently mentioned success factor in the interviews was that the model should be simple in its appearance and easy to use and to understand. This links back to one of the factors discussed in theory: To make sure that there is time enough to do the analysis and development properly. Since this thesis has a limited time frame it seems even more important that we focus on keeping the model simple and not making it too complex. Regardless of scope and limitations, the model will still cover a broad range of information sources and therefore sufficient time must be put into the data collection phase. When this data collection is done, first then the priorities and “keeping the simplicity into the model” can start. Furthermore it was discussed in the theoretical framework that having a basically correct model is good enough; another essential factor to have in mind in the development of the Duni specific cost model. The solution that will be developed will still give a better picture than is available today even if it might not be 100% correct, something that might not even be possible to achieve anyway.

Another important factor mentioned in the theory of LCC, see section 4.4.4.4 *Success Factors*, is to have top management support in the development project, and further on in the usage of the model. In this case, the steering group plays an important role. Furthermore, a success factor mentioned in the empirics that might help with this risk is the need of having one person responsible for the model. This would help

the maintenance of the model and to make sure that the model also will be sufficiently updated through time.

Finally, a request made by one of the future users of the model was that the model should be localized and able to be used offline. To fulfill this requirement we think that the best solution is to develop the model in Excel. Then the users are able to have the model locally at their computers and when the file is updated over time the new file will be sent out to the users so that they can exchange the old model. The usage of Excel will also help keeping the model easy to use since the users already are familiar with this program.

## 6.5 Performance Measurements Analysis

Due to the time limits of this thesis and that the head scope not has been to analyze the performance measurements at Duni, all the separate Duni KPIs will not be analyzed and evaluated in this section. Instead the more overall structure of the KPIs and potential improvement areas will be discussed and recommendations will then be given to Duni, based on the outcome of this analysis.

According to theory it is important to measure the purchasing performance within a company to help the purchasing function succeed in reducing the company's overall supply risk and to contribute to the business in a positive way. Duni has currently started to work with this since they have started using KPIs to measure performance within their various functions. However, it might be difficult to decide which measurements to use, and as described in section 4.5.6 *Application of KPIs* it is unrealistic to have sufficient KPIs for all suppliers, products and areas within a company. Therefore it is important to decide for what scope the measurement is required, and to make sure that it fit to the overall business strategy. This has been an issue at Duni; the impression was that they had created some KPIs without a good analysis behind it. Not all employees agreed with the set of KPIs, and in some cases they were skeptic towards if the set of KPIs really measured what was important. Furthermore some employees did not consider all of the KPIs to be good indicators for performance or not even measurable in a proper way. Therefore it is important that the management team clarifies the purpose behind the measurements and why the chosen KPIs will be beneficial. It is also important that they develop the measurements in collaboration between various departments. This in order to not only maximize the outcome of each department but to make sure that the whole business is affected by the results in a positive way.

Moreover, in theory, see section 4.5 *Performance Measurements*, four important dimensions were discussed to take into account in the purchasing measurements: price & cost, product & quality, logistics and an organizational dimension. It seems like Meal Service is involving at least some of them, especially the price & cost dimension. As we have understood it, a lot of the focus within the sourcing team is put on cost savings and it is clear that this is of great importance since they even measure this visually in the office. Furthermore it was discussed in the theory that these purchasing savings should be reported at a company level instead, since the purchasing activities should work cross-functional within the organization. This might be the next step for Duni as well, when they will start to work even more cross-functional and getting better control over the cost situation through the usage of the cost model. In addition, Duni should think about how they involve the other dimensions in their measurements, to make sure that they also are contributing to a total quality control, to an efficient incoming flow of purchased goods, and to make sure that the purchasing resources are used in the best possible way. In order to do this they could use the KPIs listed in the theoretical framework, see section 4.5.5 *Key Performance Indicators, KPIs* as an inspiration to better develop both purchasing effectiveness and efficiency in the purchasing work through sufficient KPIs.

## 6.6 Findings

Both similarities and differences could be found between literature and practice, regarding the expectations and usage areas of a cost model. The total picture gained from the interviews held at Duni correspond quite well with the summary of the described theoretical cost models. However, since the purpose not has been to find and use an existing cost model it was no surprise that there was not one

particular cost model that perfectly suited the Duni needs. The time constraints and directives about the scope, made that some models could not be used fully as they were. However, the major differences between theory and the empirical data was mainly due to those limitations. Also, the needs of Duni almost suit the requirements for a landed cost model. The only significant difference was found to be the outbound logistics. The further development of a cost model can therefore be seen to be a limited landed cost model or a Duni specific cost model, based on the most suitable aspects from the whole theoretical framework of cost management as well. This model will hopefully suit the Duni needs in best possible way and might function as a solution for other companies to use in the future as well.

The findings, regarding cost elements and cost drivers, from the analysis are summarized in Table 25 below. These are the cost elements and cost drivers that will be included and further assessed in the construction of the cost model.

Cost Elements	Cost Drivers
<ul style="list-style-type: none"> <li>• Warehouse cost (handling, administration, depreciation)</li> <li>• Storing cost (internal/external)</li> <li>• Freight cost (inbound/internal)</li> <li>• Purchase price</li> <li>• Quality issues</li> <li>• Customs duties</li> <li>• Tied up capital cost</li> <li>• Cost of keeping discontinued articles on stock</li> <li>• Scrapping cost</li> <li>• Currency risk</li> <li>• Cost for repacking due to damages</li> <li>• Packaging cost</li> <li>• Palletizing cost</li> </ul>	<ul style="list-style-type: none"> <li>• MOQ</li> <li>• Re-packing/handling at port</li> <li>• MPQ</li> <li>• Currency</li> <li>• Payment terms</li> <li>• Order structure</li> <li>• Lead time</li> <li>• Phase in/out</li> <li>• Product type</li> <li>• Warehouse and safety stock location</li> <li>• Number of articles</li> <li>• Delivery performance by supplier</li> <li>• Incoterms</li> <li>• Truck load</li> <li>• Sales estimates</li> <li>• DOI - days of inventory</li> <li>• Commitments</li> <li>• Supplier location (Asia/Europe)</li> <li>• Poor communication</li> <li>• Sales incentives</li> <li>• Stock levels (safety stocks)</li> <li>• Obsolete/discontinued articles</li> <li>• Warehousing performance (productivity/capacity)</li> <li>• Promised delivery reliability</li> <li>• Inventory turnover</li> <li>• Scrapping process (limits)</li> <li>• Pallet load (full/mixed)</li> <li>• Customer service</li> <li>• Bonus programs/KPIs</li> <li>• Quality</li> <li>• Forecast uncertainty</li> </ul>

Table 25. A summary of the cost elements and cost drivers.

The applications and success factors that will be considered in the further construction of the cost model are summarized in Table 26 below.

Applications	Success factors
<ul style="list-style-type: none"> <li>• The head users of the model should be the sourcing team and the category managers</li> <li>• Support in sourcing and assortment decision making</li> <li>• Show a holistic view of the true costs related to products</li> <li>• The model should visualize potential trade-offs</li> <li>• Bring transparency and highlight potential cost savings</li> <li>• The model should provide cost information effectively and quicker than today</li> <li>• Through the usage of the cost model it should be easier for the Supply Chain function and for Meal Service to work cross-functional</li> </ul>	<ul style="list-style-type: none"> <li>• The model should be simple in its appearance</li> <li>• The model should be easy to use and to understand</li> <li>• The model should show graphical views</li> <li>• The users should be able to use the model offline by having it localized at the users computers (Excel)</li> <li>• The users opinions should be of guidance in the development of the model</li> <li>• The development should start on a small and basic scale</li> <li>• Emphasize on including cost elements with a significant contribution to the total cost but also cost elements that can be affected by the sourcing team</li> <li>• Calculate with true costs</li> <li>• There need to be one assigned person or role connected to the ownership of the model</li> <li>• The model should be updated regularly with sufficient input data</li> <li>• Basically correct is good enough</li> <li>• Top management support</li> </ul>

Table 26. A summary of the applications and success factors.

In addition, the comparison between the theory and the empirical data stresses how important cross-functional integration is in order to have a successful purchasing department. It also shows the importance for the whole business to work towards mutual goals in order to achieve the corporate objectives. At Duni it seems that the communication and cross-functional work does not work as it should, which has led to misunderstandings and a lack of both knowledge and transparency. Cross-functional work is something that the theory highlights several times and it cannot be said enough how important this is, and empirics confirmed it in the interviews.

## 7 Construction of the Cost Model

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*This chapter includes the whole construction of the cost model. Firstly it is described what parameters that were chosen to involve in the model, through analysis and workshops. Furthermore a detailed description of the actual model follows, including a lot of pictures showing the layout and content of the model. The chapter is finalized with how the model was tested and some elaboration about the applicability of the construction.*

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### 7.1 Analysis

The specific findings from the analysis of cost elements and drivers were further assessed to better understand the nature of them. One key takeaway from the analysis of potential success factors was to focus on the most important cost elements and cost drivers in order to make sure that there was time enough to develop a useful model for Duni. Additional information<sup>27</sup> regarding the identified cost elements and drivers was therefore gathered. The aim of the analysis was to get a deeper understanding about what significant impact each of the identified cost elements had on the total cost and also what drove each specific cost to arise. The latter information, regarding cost drivers, was needed in order to assess what impact the sourcing team at Meal Service had on each of the cost elements.

The information provided was firstly assessed thoroughly and mostly against each other in order to get an idea of the cost situation for each of the cost element. This resulted in some important findings rather quick:

- The cost of re-packing goods due to damage was not a cost that anyone had close at hand. This cost element was mainly meant as the resource cost for doing this and the cost for resources was not broken down on such a detailed level at Duni. There was no activity-based costing done on this matter as well. What we did find out was, though, that the estimated cost for re-packing, made by the business controller within logistics were insignificant in comparison with the cost situation for the other identified cost elements. We therefore decided to not include it in the further study.
- Scrapping cost was another cost element that were decided to not be further investigated due to this analysis. Partly because of the lack of information regarding this aspect. As mentioned earlier in this paper, see 6.2.3.3 *Tied Up Capital or Scrapping*, there was an absent of knowledge regarding the whole scrapping process, the matters leading up to it and also the result of not scrapping when you ought to. Because of the lack of knowledge this seemed to be an important aspect to take into this cost analysis, both for the involved at Duni but also for the researchers. Any information about cost for the actual scrapping process were, however, difficult to get a hold on. However, the cost for keeping the discontinued and obsolete articles on stock could be calculated. We did, therefore, decide to only include the latter cost element in the further study. This could hopefully give an indication on the result of not dealing properly with the scrapping process, and the cost for the actual scrapping could be a future cost element to include in the model.
- The cost for quality issues were also decided to not be investigated further since it turned out that Meal Service did not suffer any major concerns regarding this. This was found when we sought for more information about this cost element, as described in section 3.5.4.1.1 *Pattern-matching*.

Regarding the palletizing cost it was found out to be included in a cost element consisting of several handling costs at the port outsourced to another company. Therefore we considered this cost element as “Handling at port” in the continued study. All of the cost elements that were now further assessed in the study can be found in Table 27.

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<sup>27</sup> This was mainly quantitative data, such as cost data or information about quantities and time units. The procedure for the data collection is described in section 3.5.4.1.1 *Pattern-matching*

Cost Elements
<ul style="list-style-type: none"> <li>• Purchase price</li> <li>• Packaging cost</li> <li>• Inbound freight cost</li> <li>• Internal freight cost</li> <li>• Handling at port</li> <li>• Customs duties</li> <li>• Warehouse handling cost</li> <li>• Warehouse administration cost</li> <li>• Warehouse depreciation cost</li> <li>• Warehouse Storage cost (internal/external)</li> <li>• Tied up capital cost</li> <li>• Cost of keeping discontinued articles on stock</li> <li>• Currency risk</li> </ul>

Table 27. The findings from the analysis regarding cost elements.

When these elements were decided the authors continued by connecting the identified cost drivers, see Table 28 below, based on the interviews and the theoretical framework. With both the cost elements and these cost drivers further analysis could be done and are shown in *Appendix 5*. The result of that analysis were then used in workshop 1, where further discussion and decision-making were on the agenda.

Cost Drivers	
<ul style="list-style-type: none"> <li>• MOQ</li> <li>• Re-packing/handling at port</li> <li>• MPQ</li> <li>• Currency</li> <li>• Payment terms</li> <li>• Order structure</li> <li>• Lead time</li> <li>• Phase in/out</li> <li>• Product type</li> <li>• Warehouse and safety stock location</li> <li>• Number of articles</li> <li>• Delivery performance by supplier</li> <li>• Incoterms</li> <li>• Truck load</li> <li>• Sales estimates</li> <li>• DOI - days of inventory</li> </ul>	<ul style="list-style-type: none"> <li>• Commitments</li> <li>• Supplier location (Asia/Europe)</li> <li>• Poor communication</li> <li>• Sales incentives</li> <li>• Stock levels (safety stocks)</li> <li>• Obsolete/discontinued articles</li> <li>• Warehousing performance (productivity/capacity)</li> <li>• Promised delivery reliability</li> <li>• Inventory turnover</li> <li>• Scrapping process (limits)</li> <li>• Pallet load (full/mixed)</li> <li>• Customer service</li> <li>• Bonus programs/KPIs</li> <li>• Quality</li> <li>• Forecast uncertainty</li> </ul>

Table 28. The findings from the analysis regarding cost drivers.

### 7.1.1 Workshop 1

The goal of workshop 1<sup>28</sup> was to take a final decision about what cost elements to include in the cost model. The purpose was also to determine which cost drivers that should be the primary focus in the initial model building phase, and how the model should be used. The outcome of workshop 1 was also

<sup>28</sup> The participants of workshop 1 was the members of the steering group.

for the researchers to take a final decision about how to develop the model, i.e. if it should be developed according to one of the studied cost models or if it were to be a Duni-specific model, however based on the prior knowledge regarding cost models.

### 7.1.1.1 Cost Elements & Drivers

In the beginning of the workshop the final results from the analysis, regarding cost elements, were shown to the participants and can be seen in Figure 16. A discussion followed and it was decided that the cost elements involved were sufficient for this first model. The only cost they wanted us to include as well, was the plastic duty that occurs when plastic products are imported to Europe, something that had not been mentioned before in the interview study. It was also decided to include the packaging cost within the purchase price. The participants in the workshop however encouraged that the costs were kept on a basic level to begin with.

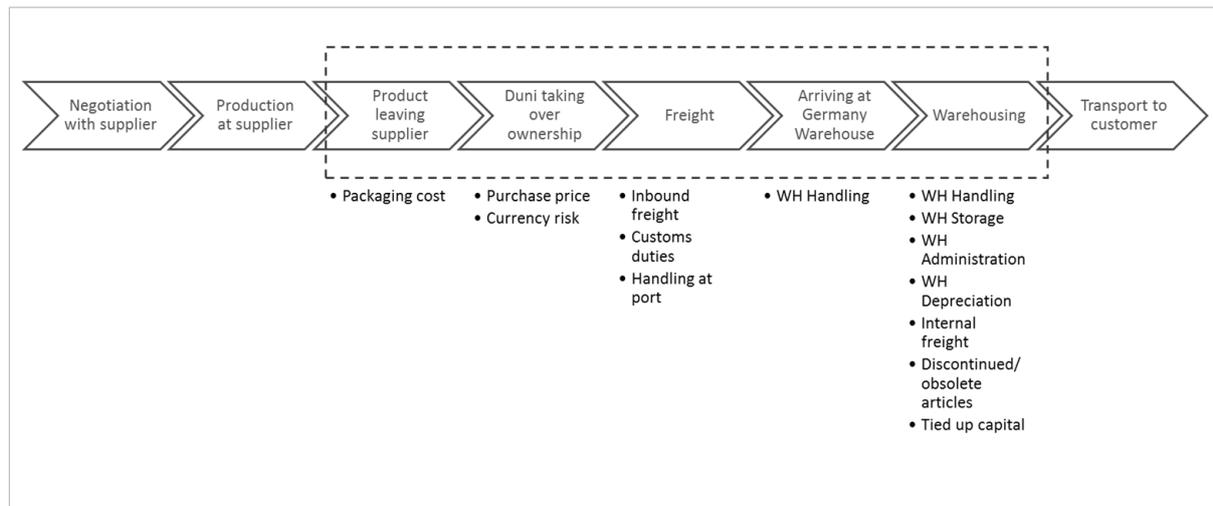


Figure 16. The cost elements identified from the analysis.

Furthermore, the prioritizing of cost elements and cost drivers, made in advance, were presented to the participants according to Table 29. These cost drivers were the ones connected to the cost elements with the highest influence on the total product cost and with the highest possibility for Meal Service to be able to affect.

Cost Elements	Cost Drivers
<ul style="list-style-type: none"> <li>• Purchase price</li> <li>• Warehouse handling cost</li> <li>• Warehouse storage cost</li> <li>• Cost of keeping discontinued articles on stock</li> </ul>	<ul style="list-style-type: none"> <li>• MOQ</li> <li>• Number of articles</li> <li>• Supplier location (Asia/Europe)</li> <li>• Order structure</li> <li>• Scrapping process</li> <li>• Inventory turnover</li> <li>• Promised delivery reliability</li> <li>• Bonus programs/KPIs</li> <li>• Sales estimates</li> <li>• Sales incentives</li> <li>• DOI – Days of inventory</li> </ul>

Table 29. The cost drivers connected to most of the cost elements with highest influence on Meal Service business

The steering group agreed on emphasizing the four cost elements. The cost drivers above were also discussed at the workshop. However, they had opinions regarding which to prioritize in the further study and some of the other identified cost drivers, see Table 28, were also discussed. It was decided that the following cost drivers should be our main focus in the development of the cost model:

- Lead time, which was decided to be a better parameter than only where the supplier was located.
- Minimum order quantity (MOQ), a parameter that the sourcing team currently have started to work with together with their suppliers and a parameter that could be affecting many of the costs.
- Inventory turnover ratio, which was decided to be an output of the model that the user should be able to compare to a set minimum goal at Duni.

The other drivers were categorized as parameters to possibly investigate and involve in a future development of the cost model. Furthermore, drivers such as payment terms (currency<sup>29</sup>), sales estimations, supplier location and product type (plastic or not) will also affect the outcome of the model since they will work as input parameters to the model.

Since the sales estimations at Duni often were incorrect<sup>30</sup> it was discussed whether this should be taken into consideration in the model or not. It was however decided that the sales estimation should be kept as it is and that the steering group will put focus on improving the sales estimations from scratch instead. However, as shown in the model building section below, a graph was created in the model to show how some products might be very sensitive to the sales volume.

#### 7.1.1.2 Application

During the initial phase of this thesis it was decided that the usage of the model should be in sourcing decisions and also economic life-cycle decisions of a product. These usage areas were presented during this workshop again and they were further discussed. It was decided that the purposes remained with some additional requests:

- The model should show the user the true cost of a product, better than the cost estimations that are done within Duni today
- It should be possible for the user to compare different articles or the same article with various input parameters
- If possible it should be possible for the user to see how big the various costs are related to the total cost

#### 7.1.2 Findings

With the output from workshop 1 and the findings from the prior analysis in section 6.6 *Findings*, the researchers did not consider that the cost model should be developed according to TCO, ABC or LCC. This, was also very much depending on the scope and the time limitation of this study, something that was clearly stated as a drawback for several of the cost models. The final findings regarding Duni's need is, however, still suitable for the requirements of a landed cost model, except for the cost element of outbound logistics to customer. Thus, we believe that the findings of the analysis can be used to construct a Duni specific cost model fulfilling the organization's most important requirements for now, but with the potential of further developments in order to receive a full-scale landed cost model. With the purpose of the study in mind the building of the cost model started.

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<sup>29</sup> Other payment terms such as number of days to pay an invoice was not included in this first model.

<sup>30</sup> It was brought up as an issue by several of the interviewees from the Supply Chain department, see especially section 5.1.3.1.2 *Cost Elements & Drivers*.

## 7.2 Model Building

In this section the details of the model building and all parameters and calculations in the model will be explained.

### 7.2.1 Guidelines

Two complementing documents were created beside the model: a user guide<sup>31</sup> and a model manual<sup>32</sup>. The user guide includes the information that the model users need in order to put the right input into the model and to know how the results should be interpreted. The guide also includes guidelines with potential actions that can be taken based on the various results and how the analysis part of the model can be used. Furthermore, when it comes to the model manual this includes a detailed description of all the content in the model so that the model responsible person at Duni should know how the model is set up. This manual also includes information about how the costs are calculated and who is responsible for the specific model input parameters.

### 7.2.2 Overall Structure

The model was created in Excel, due to the demands from Duni that the model should be a user-friendly tool easy to access even in offline mode, in example during a negotiation. Excel was also used due to the fact that the users already had a lot of knowledge in how to use Excel and Duni did not yet had another similar tool to use.

The model contains of nine sheets, of which three are open to view for the user. The rest of the sheets work as backup sheets and include the different costs and the calculations behind them. Here follows a short description of all the sheets and what they include. The sheets including the cost calculations will be explained more in detail in the section *7.2.3.2 Cost Elements in the Model*.

The units of the various parameters in the model were chosen with purpose to be as easy and natural as possible for the users, i.e. the sourcing team. Then the users can take the existing information and directly put it into the model, without needing to convert the numbers into other units. However, due to the fact that the sourcing team often use pieces as a unit and that the logistic team always use pallets as their unit, the model has some conversion formulas built in, which is further described in section *7.2.3.2 Cost Elements in the Model*.

### 7.2.3 The Duni Specific Cost Model

In this section the model is described in detail with all formulas and in-data that were used in the cost model construction.

#### 7.2.3.1 Layout

The model in Excel consists of nine different sheets: three of which the users are expected to use and the rest including all the underlying data behind the model. The model is built so that it can be used by up to 1500 articles or different alternatives at the same time.

##### 7.2.3.1.1 Sheet 1 – User Page (yellow sheet)

This is the page for in-data – filled in manually by the user. The yellow fields are the ones that need to be filled in with information and they contain the following parameters:

- Alternative description
- Supplier MOQ
- Product price (purchasing price)
- Price unit
- Currency factor between USD and EUR
- Sales estimation

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<sup>31</sup> The user guide can be found in *8.3.2 Appendix 7*.

<sup>32</sup> The model manual is left out of this thesis due to confidentiality.





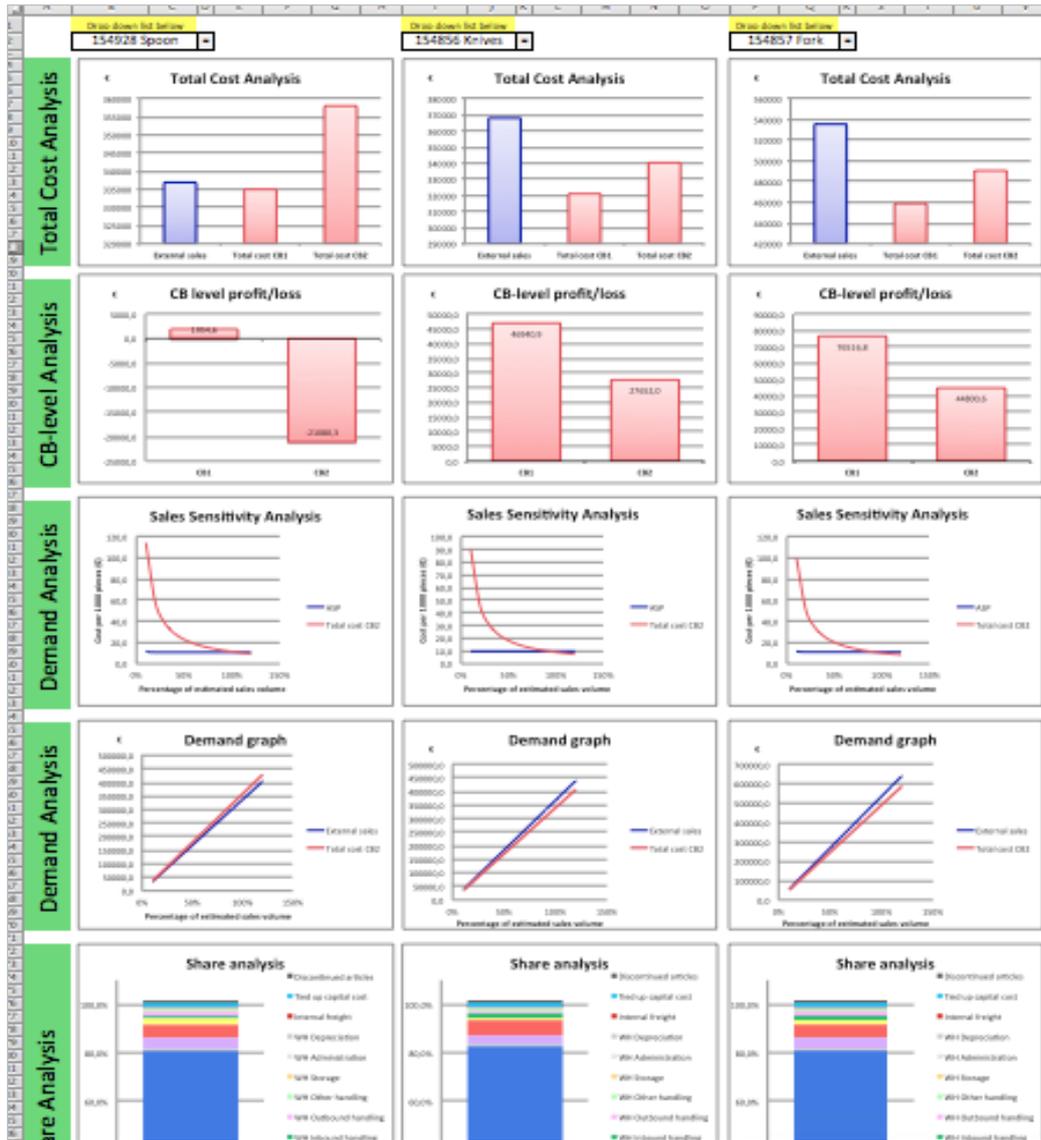


Figure 19. Sheet 3 - the Analysis Page

The first graph (Figure 20) shows the Average Sales Price compared to the first and second cost levels in order to see how they might differ.

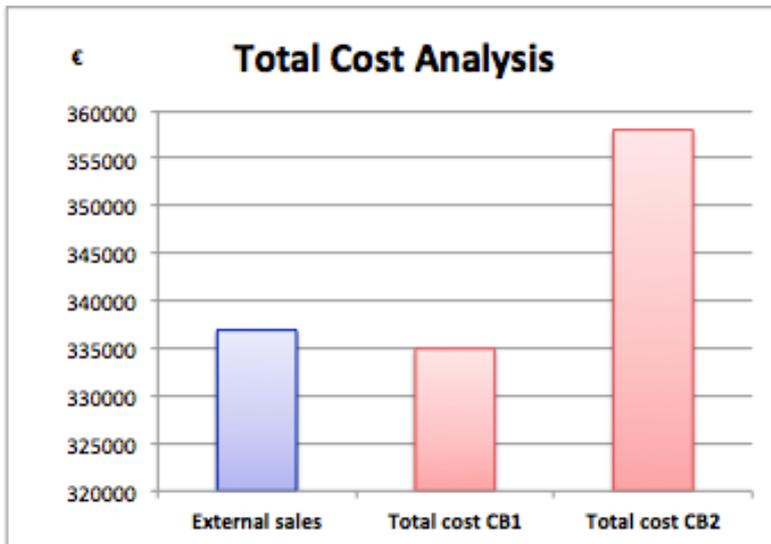


Figure 20. Total Cost Analysis graph

The second graph (Figure 21) includes the both margin levels described in the result sheet above. The purpose of this is to be able to compare the actual results to each other's and to see how good or bad the margins are.

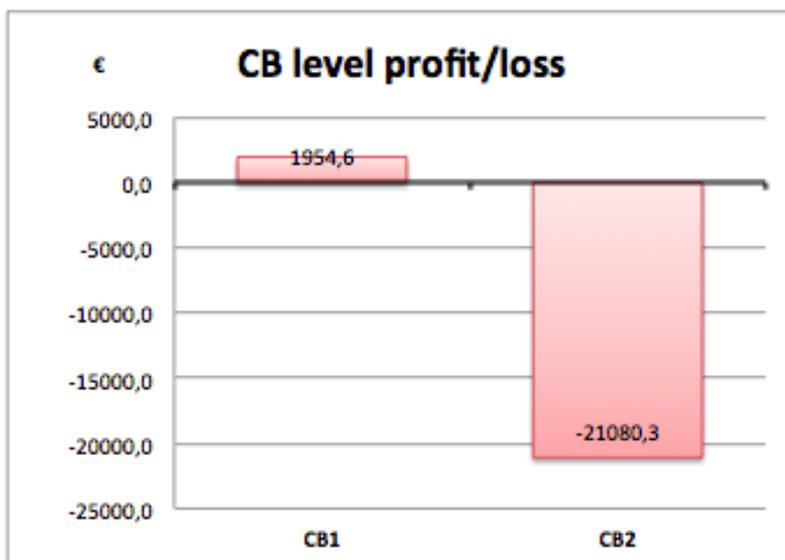


Figure 21. CB level profit/loss graph

The third graph (Figure 22) is a sales sensitivity curve that shows how the cost would change if the actual sales volume would differ from the estimated sales and how this cost is related to the price. This could give an indication that the product includes a large sales risk depending on when the cost and price curves intersect.

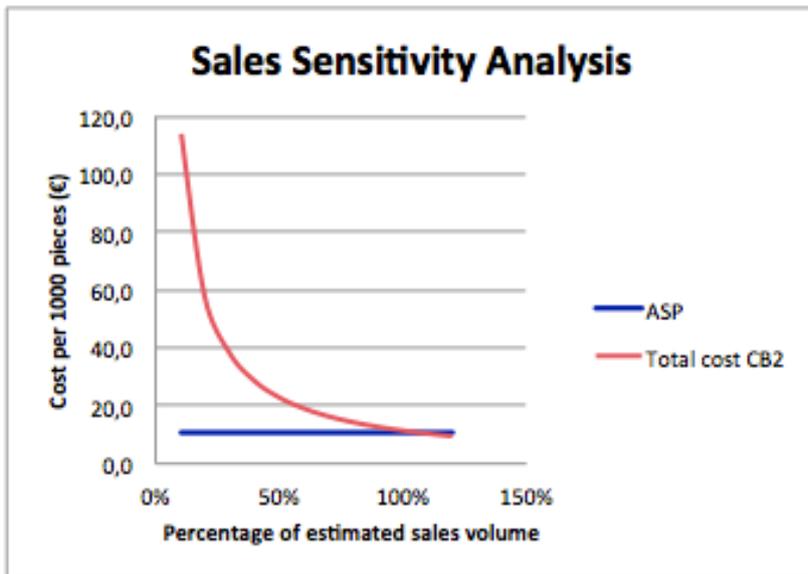


Figure 22. Sales sensitivity analysis graph

The fourth graph (Figure 23) shows the relation between the sales volume and the total cost of the product, assuming that the volume purchased by Duni follows the actual sales volume. If the outcome is as in Figure 23, the total cost will always be higher than the external sales, despite the sales volume. Then the sales price needs to be increased, or costs tried to be reduced, in order to make the product profitable.

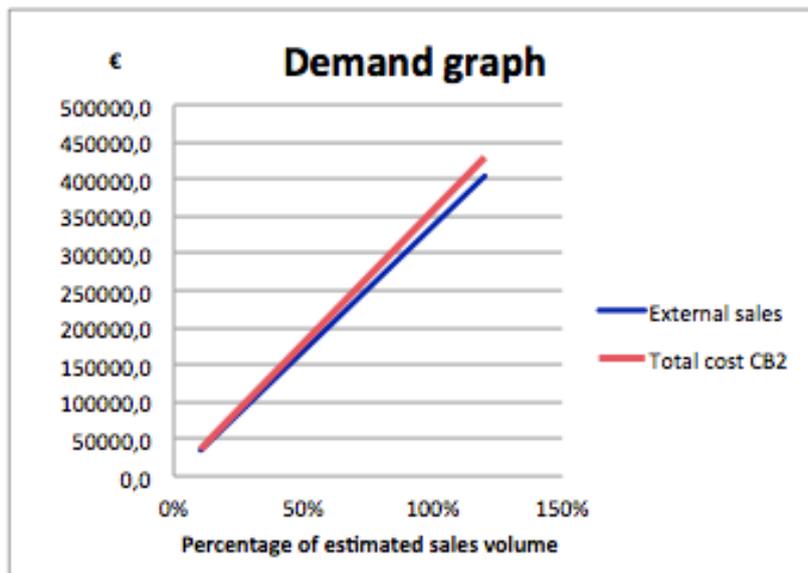


Figure 23. Demand graph

The fifth graph (Figure 24) is a cost share analysis of the different costs included in the total cost of this model. Here the user can see how big share of the total price various costs have and how big they are in relation to each other<sup>33</sup>.

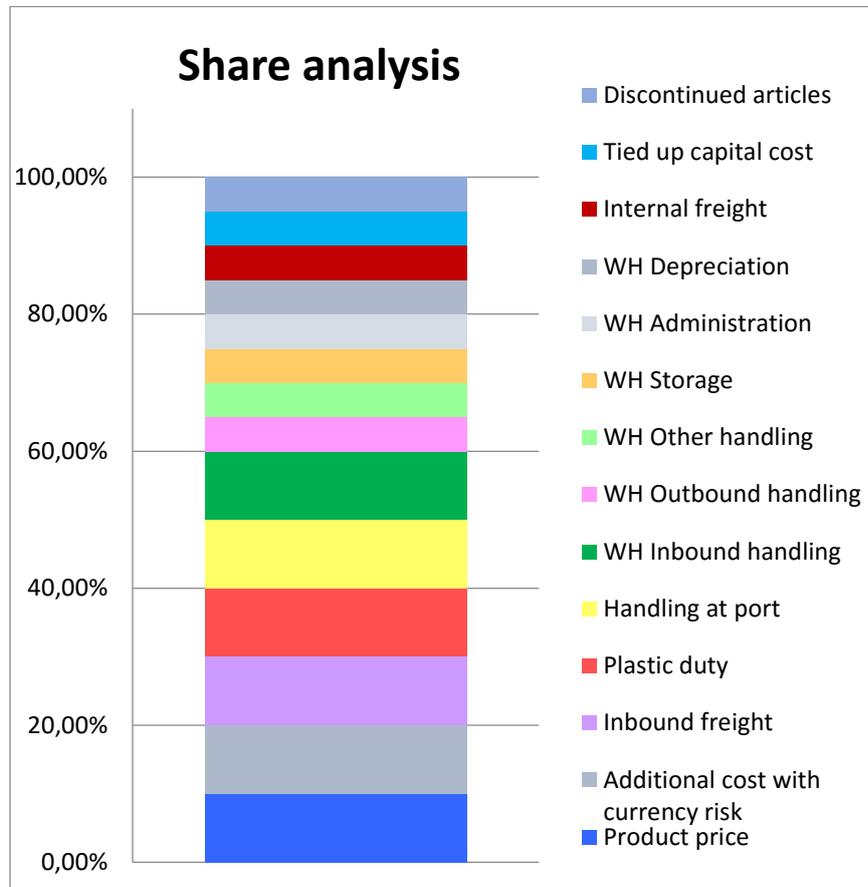


Figure 24. Share analysis graph

#### 7.2.3.1.4 Sheet 4-9 – the Backup Sheets

These sheets consist of the following areas: Model Input Parameters, Calculations, Costs, Warehousing, DOC and Average Stock Levels. The Model Input Parameters are the numbers that should be updated by the model owner once or twice per year including i.e. the total warehousing cost, freight cost, stock levels and other costs that will change between different years. The model input parameters are shown in Figure 25.<sup>34</sup> Furthermore, some of the recommendations in this thesis are done with these parameters in mind, to make sure that the output from the model will be even better in the future. The other areas will be described in detail in the following section.

<sup>33</sup> The relations shown in Figure 24 are made up and do not reflect the real cost share situation within Duni, due to confidentiality.

<sup>34</sup> Due to confidentiality the actual numbers are left out from this thesis.

Model input parameters
Maximal cost at port (Hellmann)
Number of pallets in one container
Yearly total internal freight
Meal Service Business Share Sales
Number of inbound Meal Service pallets per year, IDC Central
Average number of SKUs per pallet MS
WACC - weighted average cost of capital
Average DOI Meal Service Total
Number of outbound Meal Service pallets per year, IDC Central
Total Warehouse Handling cost
Total Warehouse Storage cost
Total Warehouse Administration cost
Total Warehouse Depreciation cost
Meal Service average stock IDC Central
Meal Service obsolete pallets, percentage of total stock levels
Average freight cost per road shipment in EU
Average nbr of pallets per road shipment in EU
Average freight cost sea freight
Plastic duty
Lowest currency factor USD/EUR last 5 years

Figure 25. Model input parameters

### 7.2.3.2 Cost Elements in the Model

Since the scope of this thesis should to focus on the costs between the point where Duni takes over the ownership of the product and the point where the product is ready to leave the warehouse to the customer, the following costs are included in the model:

- Purchasing price
- Additional cost with currency risk
- Inbound freight cost
- Plastic duty
- Handling at port cost
- Warehousing cost
- Internal freight cost
- Tied up capital cost

The warehousing cost is split into further categories and they are then divided in the model in various ways. In the following sections there will be a further explanation to how all of the above-mentioned cost elements are divided and calculated in the model. The unit of sales estimation, which is reoccurring in the formulas, is in *pieces* when filled in by the users. This is then converted in the model to *pallets*, when used in the formulas below. This is due to the use of different units within Duni, and how cost elements, thus, can be measured either in pieces or in pallets. The conversion is based on the parameter *number of pieces per pallet*, which is filled in by the user. Moreover, all costs are connected to the German warehouse as set in the scope.

#### 7.2.3.2.1 Purchasing Price

The product purchase price, including packaging cost, is filled in by the user at the first page and then multiplied by the sales estimation to get the total purchasing cost per article and year. If the purchasing price is in USD a conversion to EUR is made with the currency factor of today that also was filled in by the user.

$$\textit{Total purchasing price} = \textit{purchasing price} * \textit{sales estimation}$$

#### 7.2.3.2.2 Additional Cost with Currency Risk

Here the model checks if the product is sourced in EUR or in USD. Since Duni works with EUR in their business there will be a currency risk added if they are contracting a price in USD. If this is the case the model uses another currency factor than the actual factor of today, to be able to show what the cost would be if the currency would go down to the worst case scenario. Since the reality of today is very close to the all-time low currency factor between EUR and USD it was decided to use the worst-case scenario as an input to the currency risk. This might however be something that changes in the future if the currency goes up and the risk factor then might be an average calculated based on historical data instead of the all-time low as is used today.

The lowest currency factor between EUR and USD the previous 5 years: 1,0552 (Euroinvestor, 2016)

*Currency risk cost*

$$= \left( \frac{\textit{purchasing cost (in USD)}}{1,0552} \right) * \textit{sales estimation} - \textit{total purchasing cost}$$

This additional cost is then used to calculate the currency risk percentage, which is presented in the results page. This cost is also included in the cost share analysis graph to show additional risk with sourcing from Asia compared to Europe.

#### 7.2.3.2.3 Inbound Freight Cost

To keep simplicity into the model the inbound freight is divided into two different costs: average freight cost for a pallet from Asian suppliers and average freight cost for a pallet from European suppliers. This due to the fact that Duni especially wants to be able to see the differences between the costs if they source from Asia compared to Europe. This is something that could be developed in the model in the future, to put in specific information linked to every supplier and by this get even better and detailed results<sup>35</sup>. But as it is today, the model checks if the article is sourced from Asia or Europe and then it collect that specific cost to add into the total cost.

$$\textit{Total inbound freight cost} = \textit{freight cost (Asia or Europe)} * \textit{sales estimation}$$

#### 7.2.3.2.4 Plastic Duty

If the article is sourced from Asia and made of a plastic material, an additional duty is added to the product when taking it into Europe.

Current plastic duty: 6,5%

$$\textit{Plastic duty cost} = (\textit{total product cost} + \textit{total inbound freight cost}) * 0,065$$

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<sup>35</sup> The authors are aware of that the freight cost is not a true cost due to these limitations. Therefore, we recommend Duni to develop this cost element in near future by involving the freight costs for specific suppliers into the model. This would then give a varying result even within Europe and within Asia, which will give a better picture than today's solution.

#### 7.2.3.2.5 Handling at Port Cost

If the product is freighted from Asia, an additional cost will occur when the containers are taken care of at the port. This handling includes i.e. custom clearance, palletizing, re-loading and loading. Duni has an agreement about this cost with another company and in this model this cost is based on the maximal costs that could occur with this agreement, split per pallet.

$$\textit{Total handling cost} = \textit{handling cost} * \textit{sales estimation}$$

#### 7.2.3.2.6 Warehousing Cost

To be able to split the warehousing costs to the articles in various ways the warehousing cost was further categorized into the following areas: handling cost, storage cost, administration cost and depreciation cost. The categorization was based on how the logistics business controller does the split of the costs today.

##### *Warehouse Handling Cost*

Since the handling cost is assumed to be the same despite how long a product is staying in the warehouse, the total warehousing handling cost is split even on all incoming Meal Service pallets per year. However, due to the fact that the handling cost is by far the largest cost within warehousing, and to be able to understand the variations within the handling cost, some further categorization was made. This to be able to track which processes that costs most money and what actions that could be taken to try to minimize these. Therefore the following breakdown of the handling cost was made: inbound handling, outbound handling (including picking, loading and the return department) and other handling (including other logistics and administration). It is the incoming pallets that affect the inbound handling and it is therefore the sourcing team that might be able to affect these costs. Furthermore the outgoing pallets drive the outbound handling cost and it is then sales (and customer behavior), and the layout of the pallets (mixed or full), that mostly is driving these cost.

The separate handling costs are all presented in the cost share analysis graph where the user can see how they are related to each other and to the total cost. All handling costs are split in the same way:

##### *Total article handling cost*

$$= \frac{\textit{total Duni WH handling cost} * \textit{MS business share}}{\textit{MS incoming pallets}} * \textit{sales estimation}$$

##### *Warehouse Storage Cost*

The storage cost is estimated to be the only warehousing cost that is depending on how long a product will be in the warehouse. Therefore the total storage cost was firstly split on the average stock level that Meal Service has in the warehouse, to be able to get a cost per pallet place.

##### *Storage cost per pallet place*

$$= \frac{\textit{total Duni WH storage cost} * \textit{MS business share}}{\textit{MS average stock levels}} \\ - \textit{storage cost for discontinued goods}$$

Furthermore, to be able to distribute this cost to the specific article it is calculated in the model what the estimated average stock level for this product will be, how many pallet places this product will use at a time in the warehouse, based on the safety stock and the order set up for that specific product. The average stock level is calculated through the following formula:

$$\text{Average stock level} = \frac{Q}{2} + SS,$$

where  $Q$  is the order quantity and  $SS$  is the safety stock<sup>36</sup>

To get the storage cost for the specific article during a year the product average stock level was multiplied with the storage cost:

$$\text{Article storage cost} = \text{product average stock level} * \text{storage cost per pallet place}$$

#### *Discontinued articles*

It was decided that the cost of the discontinued articles should be taken into consideration in some way (and then possibly be developed even further by Duni in the future). Therefore a small part of the storage cost was dedicated to the discontinued articles cost. The model input parameter “Meal Service obsolete pallets as percentage of total stock level” was used to decide the amount of the dedication. Then this cost was split on all Meal Service incoming pallets<sup>37</sup> and then multiplied with the sales estimation to get the total cost for the investigated article.

$$\begin{aligned} \text{Total cost of discontinued articles} \\ = \frac{\text{storage cost} * \text{MS service obsolete pallets}}{\text{MS inbound pallets}} * \text{sales estimation} \end{aligned}$$

#### *Warehouse Administration Cost & Warehouse Depreciation Cost*

The warehouse administration cost and the warehouse depreciation cost are both equally shared on all Meal Service pallets per year and are calculated in the following ways:

$$\begin{aligned} \text{Total article administration cost} \\ = \frac{\text{total Duni WH administration cost} * \text{MS business share}}{\text{MS incoming pallets}} * \text{sales estimation} \end{aligned}$$

$$\begin{aligned} \text{Total article depreciation cost} \\ = \frac{\text{total Duni WH depreciation cost} * \text{MS business share}}{\text{MS incoming pallets}} * \text{sales estimation} \end{aligned}$$

#### 7.2.3.2.7 Internal Freight Cost

The internal freight cost includes the logistics costs connected to internal transfers between the different Duni warehouses in Germany. Since this cost occurs because Duni cannot store all their products in the same warehouse, and the fact that the different business areas within Duni cannot affect where their products will be stored, this cost is divided on all incoming pallets over a year.

$$\begin{aligned} \text{Total article internal freight cost} \\ = \frac{\text{total Duni internal freight cost} * \text{MS business share}}{\text{MS incoming pallets}} * \text{sales estimation} \end{aligned}$$

<sup>36</sup> Detailed information about how  $Q$  and  $SS$  is calculated in the model can be found in *Appendix 6*.

<sup>37</sup> In the future this cost should be split based on what type of product it is, in example if it is a phase in/out product, or a product with a steady demand curve. This would give a better indication of what products that are driving these costs.

#### 7.2.3.2.8 Tied Up Capital Cost

The tied up capital cost is calculated through WACC, weighted average cost of capital. Duni uses a WACC of 10% in their business calculations and the same is used in this model. The tied up capital cost calculation therefore looks as follows<sup>38</sup>:

$$\text{Tied up capital cost} = (\text{Product price} + \text{freight cost} + \text{duty} + \text{handling at port cost}) * 0,10$$

#### 7.2.3.2.9 Use of Cost Elements

All above costs are then added to each other and create the total product cost. Due to the scope of this thesis, costs that occur before the product is purchased from the supplier or after the product leaves the Duni warehouse to the customer are not included in this model. These costs will be recommended to Duni to investigate in a future development of the model, so the total cost will be even more sufficient.

### 7.2.4 Workshop 2

The second workshop was held during the model development in order to brainstorm about how some of the costs should be divided in the model. In example it was during workshop 2 decided that it only was the warehousing storage cost that should be split based on time in inventory whereas the handling cost was discussed and agreed to be the same despite on how long a product stayed in the warehouse. Furthermore it was decided that the handling cost should be split into some more categories, to be able to show where the largest part of the handling cost was and what part of the business that was affecting it.

It was also decided during workshop 2 that that the model should be built in column-format (as shown above) since they were using this format in their other models and it is easier to take print screens from it.

Furthermore, what Meal Service business share that should be used for currency risk, and what units to use in the model were discussed and decided. The decisions from this workshop resulted in the model that was presented in the previous section.

## 7.3 Testing the Construction

When the model was developed, we were provided with some real cases that we could use in the model in order to test it. We got articles from different suppliers, in different materials and within various product categories at Meal Service. By this the input parameters were widely spread and it was a good start for us to test the model. The tests were made by a sensitivity analysis and some further workshops.

### 7.3.1 Sensitivity Analysis

From the sensitivity analysis we could see that the various connections within the model were correct and that the model behaved as it should, when we varied the parameters in several ways<sup>39</sup>. When mistakes were found the model was adjusted accordingly in order to make sure that the correct results were achieved.

### 7.3.2 Workshop 3 & 4

In workshop 3 and 4<sup>40</sup> we got feedback to change some of the units, in example some units that were in pallets that would be easier for the users, i.e. the sourcing team, if they would be in pieces instead. It was also suggested that some further graphs should be added into the analysis sheet. Otherwise the workshops worked according to plan and the users got to test the model and to help us see that the results were relevant for the example cases that we were provided, both by the future model users in workshop 3 and the steering group in workshop 4.

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<sup>38</sup> This is the way Duni has chosen to calculate the tied up capital cost today and what parameters to included. In the future this might include further handling costs as well.

<sup>39</sup> Details about the sensitivity analysis can be found in *Appendix 8*.

<sup>40</sup> More information can be found in section *3.5.5.2 Workshops 3 & Workshop 4*

## 7.4 Applicability

As shown in the previous sections this model includes a holistic perspective of the cost situation at Duni. Therefore the model can be used to gain transparency within the organization and to visualize the true cost situation. The model can then also be used to find potential cost saving and to identify problem areas and potential improvements.

Furthermore the model can be used in many various sourcing decisions, like to analyze a specific supplier or to compare different alternatives. These alternatives could be various suppliers, different products or how much that should be purchased of a specific article. By this it can be seen how the total cost will differ depending on the input parameters and which trade-offs that might need to be done in various cases.

In addition the model can be used to analyze a whole assortment to find the least profitable products that might need further analysis. The users at Duni should be aware that the costs are calculated for the German warehouse but could of course be used as an indication for other warehouses as well.

## 7.5 Relate Back to Theory

The model developed in this research is Duni specific and therefore not exactly the same as the models that were presented in the theory and which were used as inspiration. However, if relating this model back to the theory it can be argued that the Duni specific model is almost the same as the Landed cost model. The only obvious difference is that the Landed cost model includes the outbound logistics cost as well whereas this was scoped out of this thesis. Although it has already been discussed at Duni that this parameter might be involved in a further development at Duni and then the model could be considered to be a full-scale Landed cost model. The differences compared to a TCO, an ABC or an LCC model are more obvious. A lot more cost elements, suggested to be included in these cost models, are out of the scope for this study. To include them in the scope we would have needed an adequate time frame. To succeed with a TCO it should be based on an ABC, something that was not done at Duni. Consequently, we would have needed even more time to first conduct an ABC and then develop a TCO model.

How the time frame affected the procedure and the outcome of such a cost model was mentioned in the theory of Landed cost, section 4.4.3.4 *Success Factors*. That table also shows a lot of success factors regarding the data collection and how it should be seen as an iterative process. When taking a step back from this study we can absolutely agree with the theoretical aspects of having sufficient time and emphasizing the data collection in order to succeed. In our case it is especially the quantitative data, such as cost information and other input data to the model that would have been more developed with an extended time frame for the project. Now that we have gone through this process ourselves we would like to stress the importance of having enough time in order to conduct a comprehensive cost analysis and develop a purchasing cost model, providing as correct picture as possible of the true cost situation.

The background issue regarding cross-functionality at Duni were found to be resulting in the problems mentioned by van Weele (2014) and described in section 4.2.2 *Cross-functional Integration*. Van Weele (2014) stresses the importance of looking beyond only the purchase price. Instead of going for the lowest purchase price possible, sourcing decisions should aim at optimizing the total cost of ownership and creating the maximum value for the purchasing spend. This is, however, only possible if the sourcing team are aware of how their decisions affect the sum of the whole. The cross-functional work is therefore significant in order to make these complex decisions. The cost model itself is a tool for increasing the cross-functional work at Duni. The developed cost model will provide the sourcing team with a more holistic view of how their decisions affect the total cost of a product. It will also visualize potential trade-offs, leading to a better understanding for how they affect the business as a whole. This will help them directly to look beyond the purchase price but the holistic awareness will also help them to realize the importance of aligning the purchasing and supply strategies (van Weele, 2014) and thereby increase cross-functional work.

## 8 Conclusion & Contribution

*In this chapter the thesis will be concluded and it will be discussed whether the purpose was fulfilled or not. Conclusions will be made regarding the background issues at Duni and the research questions that have been answered throughout this research. Then the contribution of this thesis will be discussed and the chapter is finalized with some recommendations of further research & development regarding the principal company as well as in academic literature.*

### 8.1 Conclusion

The purpose of this master's thesis was stated at an early stage in this thesis and has been an important foundation throughout this research:

*The purpose of this study is to create a cost model that Duni Meal Service can use in sourcing and economic life cycle decisions, showing a holistic view of the total cost of purchasing.*

Having a cost model within purchasing functions was described in theory to be a good way to get control over costs and potential cost savings, something that also were the expectations at Duni. However, none of the models investigated in theory suited the Duni needs perfectly. A Duni specific model was instead developed, see Figure 26, with these models as inspiration and through this the purpose with the thesis was fulfilled<sup>41</sup>.

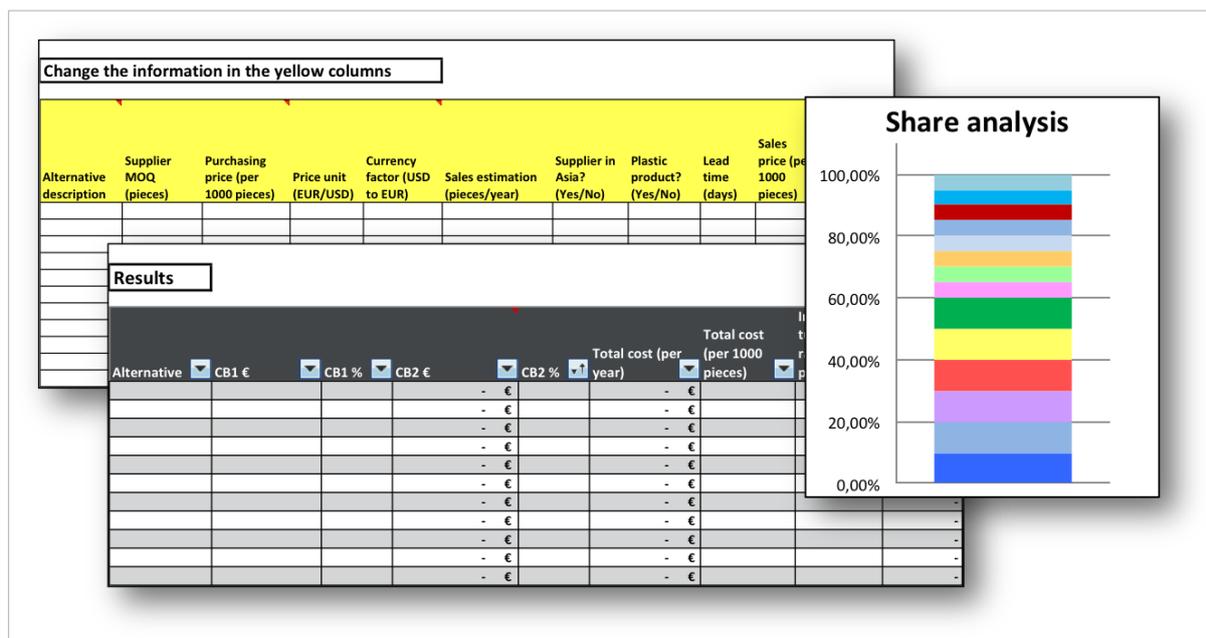


Figure 26. Some parts of the Duni specific purchasing cost model.

The model that was developed will be used to investigate what sourcing decision that will be most beneficial and also to evaluate a product's economical life cycle, i.e. be used in assortment decisions such as phase out of a product. There will also be some other usage areas as consequences because the model shows a holistic view of the total cost, such as showing potential trade-offs, increase the transparency and highlight potential cost savings. Although, Duni has some internal issues that they need to work with in order to increase the potential of a successful performance of the purchasing cost model. For instance, to increase the cross-functional integration within the organization, and to align the KPIs to the corporate strategy and take actions accordingly, based on the information provided by the cost model. They also need to make sure that the top management support is continued over time, for the use and maintenance

<sup>41</sup> Reflections upon the applicability of the developed cost model can be found in section 7.4 *Applicability*.

of the cost model. These things are of course not Duni specific but something that most organizations need to work with to increase their purchasing performance.

Regarding the actual construction of the cost model the gathered information throughout this thesis was very helpful. It worked as a guideline in the development, making sure that we kept us on the right track, focusing on the most important factors. We also felt it was easy to get the information we needed from Duni, and that the attitude towards our work always was positive. However, there was not enough time to do a full TCO, especially without an ABC to base it on. The time limitation did also affect the possibility to involve all suggested cost elements and drivers suggested by the interviewees. Despite this, a model was developed that fulfilled most of the needs. Time will tell whether the model will be successful or not, but the initial feedback from the participants at workshop 3 and 4, as well as at the final presentation, has been that the model at least met their expectations and more to it. A recommendation has been made to evaluate the model after some months and thereafter to decide how to eventually develop it further.

Furthermore, four underlying issues at Duni were described in the background of this thesis, as shown in Figure 27.

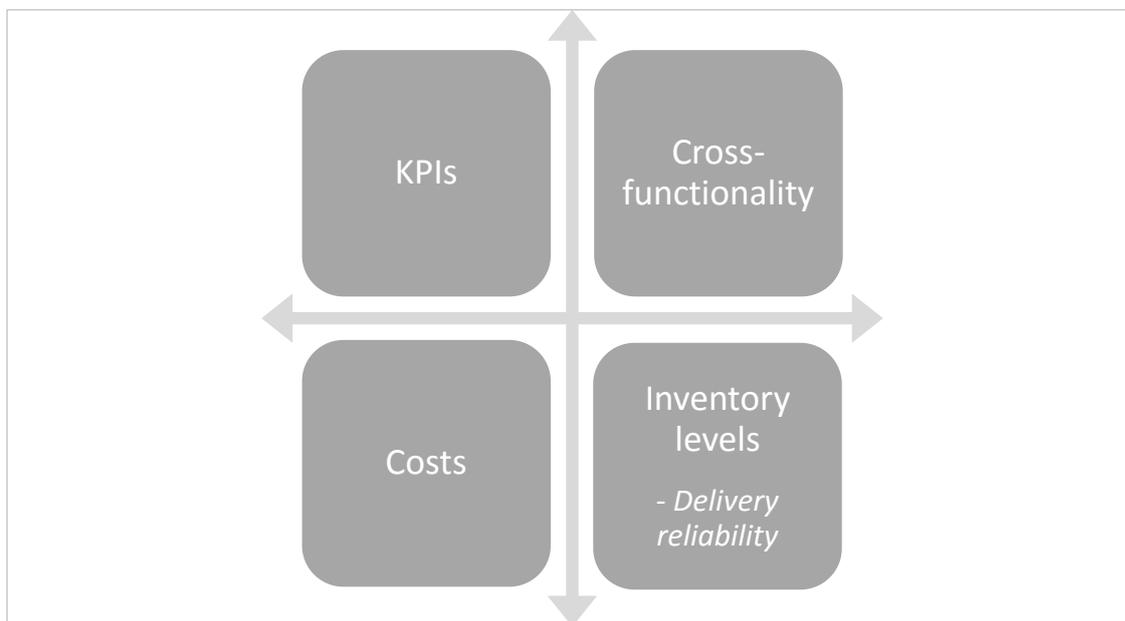


Figure 27. The background issues at Duni

When concluding how this thesis has affected above issues, it is at least a step in the right direction although not all problems are solved yet. The cost situation is now much clearer for Meal Service and the model will help them to get a good idea about how much a product really costs. Furthermore, the hope is that the model should help to increase the cross-functionality. They need to be aware of how the different departments' decisions and actions affect each other and the sum of the whole. To increase the cross-functional work, they also need to align the KPIs so that they all strive towards the same overall objectives. The model can provide information of the true cost situation and the holistic view brings a better understanding for the potential trade-offs. This will hopefully help Duni in their continued usage of performance measurements. For this issue they have improved during this thesis by showing awareness and that some new KPIs have been introduced. Finally, regarding high inventories and delivery reliability goals towards customers, the model can hopefully work as an indication of where the large costs are and what actions that could be taken to decrease these numbers. Then it is up to the management team to decide what to prioritize: low inventory levels (and thereby lower warehousing costs) or high delivery reliability to customers.

To finalize this section, the thesis's research questions will be summarized and answered. First the supporting two RQs will be presented followed by the overall RQ.

8.1.1 RQ1: Which are the relevant cost elements and cost drivers to take into consideration when doing sourcing and economic life cycle decisions at Duni Meal Service?

It was chosen to prioritize the cost elements that occurred within the scope of this thesis: From Duni taking over the ownership of a product to when the product is ready to leave the Duni warehouse to the customer, see Figure 28. It was also decided to keep the model simple which led to that the largest costs within this scope was prioritized. Therefore the following cost elements were chosen as the most important: Purchasing price, packaging, currency risk, inbound freight, plastic duty, handling at port, warehousing, internal freight, discontinued/obsolete articles and tied up capital.

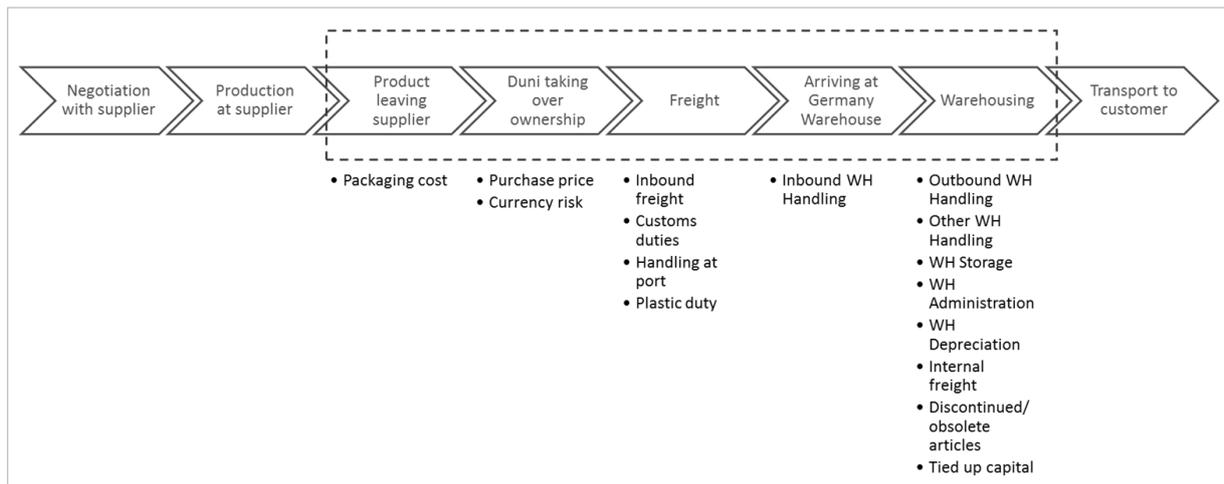


Figure 28 Cost elements chosen.

Furthermore, regarding the cost drivers it was decided, based on the request from Duni, that the most important cost drivers to include was lead time, order quantities (minimum) and inventory turnover ratio. Drivers such as payment terms (currency), sales estimations, supplier location and product type (plastic or not) are however also included since they work as input parameters to the model.

8.1.2 RQ2: Which are the key critical success factors according to literature in order to successfully implement a purchasing cost model

Some success factors regarding the cost analysis, the development of the cost model, the implementation, the usage and the maintenance of the cost model were presented in the theoretical framework<sup>42</sup> of this thesis, see Table 30 below.

Success factors
<ul style="list-style-type: none"> <li>• The importance of the empirical data collection</li> <li>• Cover a broad range of information sources</li> <li>• Consider the uniqueness of products and situations within the cost analysis</li> <li>• Emphasize cost elements and drivers with significant contribution</li> <li>• Consider standard vs. unique cost model</li> <li>• Assess whether any of the studied cost models are suitable for this project and the studied system</li> <li>• The time frame</li> <li>• Basically correct is good enough</li> <li>• Top management support</li> </ul>

Table 30. The key takeaways from the four studied cost models, regarding success factors.

<sup>42</sup> All of the success factors for each of the studied cost models can be found in Table 6 in section 4.4.5.3 *Success Factors*.

Especially one of these is connected to the implementation phase of the model: The importance of having top management support. In this case the top management has been involved during the whole project through the steering group and they have supported the work all along. Therefore this model has a great potential of succeeding. Furthermore we believe that the involvement from the users during the development phase and to keep the model simple will be other success factors in this and other purchasing cost model projects.

### 8.1.3 RQ: How to successfully develop and implement a suitable purchasing cost model at Duni Meal Service?

Finally, the conclusion of the supporting research questions pretty much sums up the answer to this overall research question. Furthermore, the following aspects are important to emphasize:

- Make sure to set a scope for the cost model to be able to keep simplicity into the model (the parameters presented in RQ1 were chosen based on the scope of this thesis, but can of course change in other cases)
- The empirical data collection is important, make sure to have time enough to do this properly and to be able to cover a broad range of information sources
- A basically correct model is good enough, it will still show an indication of the total cost which cannot be predicted perfectly anyway
- Get top management involved early so that they truly support the development and implementation of the model

## 8.2 Contribution

The main focus in this research has been to develop a cost model to Duni Meal Service. The final model was based on several theoretical cost models but will still be seen as a Duni specific model rather than seen as a product of some of the pre-defined models. Therefore this research can be used as a guide to develop a company-specific model and how to do this in a successful way for those who might be interested in doing so. The model do, however, have a lot of similarities with the requirements of a Landed cost model and can be labeled a limited Landed cost model to position it amongst the already existing cost models. With further expansion, especially by including the outbound logistics it has potential to be developed into a full-scale Landed cost model.

Furthermore, in our empirical study a lot of interviews were held with people from different departments, within various functions. This data collection might be of interest to other researchers as well, since it describes different perspectives on the focus areas of this thesis: Cost elements and drivers, application areas, success factors and purchasing measurements. This information might be used as inspiration for other companies since a lot of ideas are presented. It also shows how important cross-functional integration is within an organization and what consequences that might occur when the communication does not work properly, as a practical example of what is already described in section 4.2.2 *Cross-functional Integration*.

In addition we have tried to distinguish between cost elements and cost drivers, something that we felt were quite unclear in the existing theory. Of course it all depends on how you look upon it, but we hope that we by our distinction can help other researchers in the future to get a new perspective to take into account when investigating cost elements and drivers.

Finally we argue that the last part in our cost model, the analysis part, is good to involve into a cost model. This is not something that is described and exemplified a lot in theory, and our project might therefore be an inspiration. Even if the end result in many cases might only be the sum of the total cost, analysis can always be made including some of the sub-models, numbers and calculations that exists within the model. Then the usage areas of the model increase and more insights can be reached without adding more complexity into the model.

## 8.3 Future Research & Development

### 8.3.1 Principal Company

In addition to the developed cost model, some recommendations have been given to Duni. The first recommendations focus on the model, and the use and maintenance of it.

- Make sure to assign a person responsible for the cost model at Duni, to secure the maintenance and usage of the model.
- Evaluate the model after some months and decide whether it needs further development or not.
- Improve sales estimations so that they can be trusted in the model.
- Further assess cost elements to get a more correct picture of the cost situation. (e.g. the calculation of inbound freight cost is based on average cost data and could be further specified to better support a supplier selection within Europe or within Asia.)
- Use the model in the following ways:
  - o In sourcing decisions
  - o In economic life cycle decisions (analyzing the assortment might be a separate project)
  - o To find potential cost savings
  - o To find problem areas and potential improvements
  - o To visualize the cost situation and by this gain transparency and a better holistic understanding

The following recommendations focus more on the surroundings of the model. The information gained from the model can be used to improve these aspects. In turn, an improvement in any of these areas will have a positive impact on the use and outcome of the model. The goal, with these recommendations, is to make the most out of the usage of this cost model. Therefore, it is important for Duni to align and integrate the business processes affecting the outcome of the model. The recommendations for further development at Duni can be summarized as the following:

- Adjust the safety stock when possible since it today might be driving high stock levels when not necessary.
- Increase the inventory turnover ratio target to decrease the average days of inventory and thereby save pallet places and storage costs. (i.e. assess the forecast planning and order structure)
- Look over the process around discontinued articles, both regarding incentives to sell old products but also regarding the actual scrapping process. This to make sure that old products not drive high inventory levels.
- Try to affect the customer order behavior, a lot of outgoing mixed pallets are driving warehousing handling cost – the largest cost in the warehouse today.
- Align KPIs to the corporate strategy so that they do not counteract. Make sure that all employees understand why KPIs are used and the purpose behind the chosen measurements.
- Try to improve the cross-functional work and use more efficient communication.

### 8.3.2 Academic Literature

It is clear that this field has been discussed a lot in theory and that many authors have covered a huge amount of existing information about various cost models and their contextual aspects. However, we think that there is a potential to explore the analysis part of the cost model further and how to best use the results from a developed cost model. Some further recommendations could be given with suggestions on the study of how to actually use the information from the model into proper analysis. The applications mentioned in the studied literature, and discussed in section 4.4.5.2 *Application*, where of a broader and more theoretical perspective and it would be interesting get more practical and profound suggestions. It would also be interesting to see empirical research about how various companies have used their specific purchasing cost model in real cases and what effects that this have led to.

Furthermore there is a potential in elaborating the discussions about cost elements and cost drivers (as we have named them in this research) and how the distinction or integration should be made between them. This might be helpful not only in the development of a purchasing cost model but also in other cost related analysis within organizations.

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## Appendix 1

### Steering Group

The members of the steering group at Duni for this master thesis

Person	Function
Jesper Cederholm	Sourcing Manager Meal Service
Johan Ericsson	Senior Sourcing Manager Meal Service
Linus Lemark	Meal Service Director
Fredrik Malmgren	Production & Supply Chain Director
Wilbert Baerwaldt	Value Chain Manager

## Appendix 2

### Literature Studies

#### Search terms in the literature studies

Purchasing cost models
<ul style="list-style-type: none"><li>• Total Cost of Ownership</li><li>• TCO</li><li>• Activity based costing</li><li>• ABC</li><li>• Landed cost model</li><li>• Landed cost</li><li>• Life cycle costing</li><li>• LCC</li></ul>
Combined with below search words
<ul style="list-style-type: none"><li>• Purchasing management</li><li>• Supply chain management</li><li>• Cost management</li><li>• Cost model</li><li>• Purchasing cost model</li><li>• Total cost model</li><li>• Purchasing model</li><li>• Cost modeling</li><li>• Cost model analysis</li><li>• Cost model Excel</li><li>• Analysis</li></ul>

## Appendix 3

### Interview Guide

There was one base guide for all of the interviews, in order to gain knowledge about the most important aspects for this study. This contained questions regarding cost elements and drivers, potential application of a cost model and success factors for it. Due to the identified background issues of this problem there were also questions regarding performance measurements and general questions to gain understanding about the level of collaboration and how they worked cross-functional through the organization.

1. What is your role and work within Duni?
2. How does the collaboration with any of the other functions within Duni look like?
  - a) Would you prefer even more cooperation regarding other issues as well?
3. How does the communication with these functions work?
  - a) Do you see a need for improvement?
4. Do you lack collaboration and communication between yourself and any other part of Duni?
5. Do you see a value in this master thesis work?
6. Is Duni and especially Meal Service in need of a project like this?
7. What cost elements are there at Duni?
8. What cost elements do you think we should consider?
  - a) Which are especially important to include in a cost model do you think?
9. What drives these cost elements to incur?
10. Can you think of any other cost drivers at Duni?
11. What should the cost model be used for?
  - a) What information do you think it should provide?
12. Who should be the main users of this purchasing cost model?
  - a) Other potential users?
13. When should the purchasing cost model be used?
  - a) In what situation is there a need for such model?
14. What do we need to consider in order to develop a successful cost model?
15. What do we need to consider regarding the use of the cost model as a tool?
  - a) Suitable software?
  - b) Regarding the layout?
  - c) Other factors?
16. What do we need to consider in order to implement the cost model successfully?
17. What factors are there for a successful maintenance of the cost model at Duni?
18. What obstacles do you think we should consider?
19. Are you using KPIs for performance measurements within your function?
  - a) What are you measuring?
20. Do you consider these KPIs as a good measurement?
21. Have you been part of developing these KPIs?

## Appendix 4

### A Summary of the Interviews

Interviewee	Date	Time
Jesper Cederholm <b>Sourcing Manager</b>	2015-09-14 2015-11-03	1 h 1 h
Johan Ericsson <b>Senior Sourcing Manager</b>	2015-10-06	1 h
Carl Risholm <b>Demand Planning Manager</b>	2015-10-06	1 h
Fredrik Malmgren <b>Production &amp; Supply Chain Director</b>	2015-09-21	30 min
Linus Lemark <b>Meal Service Director</b>	2015-09-28	30 min
Magnus Carlsson <b>Business Controller Duni AB</b>	2015-10-06 2015-11-24	1 h 45 min
Olof Persson <b>Category Manager Meal Service</b>	2015-10-15	1 h
Per Lundström <b>Supply Planner Meal Service</b>	2015-10-22	1 h
Tomasz Dowejko <b>Category Manager Meal Service</b>	2015-09-15	30 min
Wiktor Hjelm <b>Business Controller Meal Service</b>	2015-09-15 2015-10-15	30 min 1 h
Alexander Büschen <b>Logistics Director</b>	2015-10-26	1,5 h
Andrea Torka <b>Transport Planner</b>	2015-10-26	45 min
Daniela Wahmhoff <b>Business Controller Logistics</b>	2015-10-09 2015-10-27	1 h 1,5 h
Dietmar Brauer <b>Business Controller Operations</b>	2015-10-26	30 min
Mattias Stuckmann <b>Supply Chain Director, Supply Chain</b>	2015-10-26	1 h
Wilbert Baerwaldt <b>Value Chain Manager</b>	2015-10-01	1 h
Uwe Gosmann <b>System developer, Supply Chain</b>	2015-10-05 2015-10-16 2015-10-26 2015-10-27	1 h 1 h 2 h 2 h
Joint interview		
Lancy Fors <b>Sourcing Manager Meal Service</b>	2015-10-15	1,5 h
Renzi Soh <b>Sourcing Manager Meal Service</b>	2015-10-15	1,5 h
Sandra Allbjer <b>Sourcing Manager Meal Service</b>	2015-10-15	1,5 h

Table 31. Interviews held at Duni.

## Appendix 5

### Analysis of Cost Elements & Drivers

Before workshop 1 was held further analysis of the identified cost elements and cost drivers were made. The cost elements and the cost drivers shown in Table 27 and Table 28, were matched with each other and resulted in the following table, Table 32.

Cost Elements	Cost Drivers
Purchase price	MOQ, MPQ, Supplier location (Asia/Europe), Product type, Quality, Currency, Payment terms, Bonus programs/KPIs, Sales estimates
Packaging cost	MOQ, Supplier location (Asia/Europe), Product type, Quality, Currency, Sales estimates
Currency	Commitments, Currency, Payment terms
Inbound freight	Supplier location (Asia/Europe), Lead time, Incoterms, Truck load
Customs duties	Supplier location (Asia/Europe), Product type
Handling at port	MOQ, Supplier location (Asia/Europe), Product type, Truck load
WH Handling	MOQ, Number of articles, Order structure, Truck load, Supplier location (Asia/Europe), Sales incentives, Warehousing performance, DOI, Scrapping, Inventory turnover, Promised delivery reliability, Pallet load, Customer service
WH Storage	MOQ, MPQ, Number of articles, Sales estimates, DOI, Forecast uncertainty, Warehouse and safety stock location, Supplier location (Asia/Europe), Lead time, Sales incentives, Stock levels, Order structure, Bonus programs/KPI, Phase in/out, Discontinued/obsolete articles, Scrapping process, Inventory turnover, Delivery performance to customer, Pallet load
WH Administration	Number of articles, Poor communication
WH Depreciation	Number of articles, Product type, Quality, Inventory turnover
Internal Freight	MOQ, Number of articles, Warehouse and safety stock location, Stock levels, Truck load, Inventory turnover
Cost of keeping discontinued articles	MOQ, Number of articles, Sales estimations, Forecast uncertainty, Commitments, Order structure, Quality, Bonus programs/KPI, Sales incentives, Phase in/out, Scrapping, Inventory turnover, Promised delivery reliability, Poor communication
Tied up capital	MOQ, Order structure, Supplier location (Asia/Europe), Lead Time, Stock levels, DOI, Inventory turnover, Number of articles, Sales incentives, Discontinued/obsolete articles, Scrapping process, Forecast uncertainty

Table 32. Cost elements and cost drivers

Due to the limited time frame we needed to prioritize what cost elements and cost drivers to emphasize, in terms of time effort and assessment to reach as correct costs as possible. As a further analysis, a xy-diagram was created with the cost elements impact on the total product cost on one axis and then an estimated value of the likelihood of how the Meal Service business area could affect the cost on the other axis. Both values were calculated or estimated as a percentage and the result is showed in Figure 29. Since all cost data were not collected at this point some values were estimated and the result may therefore not have been totally correct, however the results gave us an indication. The tied up capital is not included in this analysis since the information regarding this aspect was too little at this point to even make an estimation, however it was included in the further study.

From Figure 29 we decided that the following cost elements were the ones that should be suggested at workshop 1 to be prioritized in the further study: Product price, warehouse handling cost, warehouse storage cost and cost of keeping discontinued/ obsolete articles.

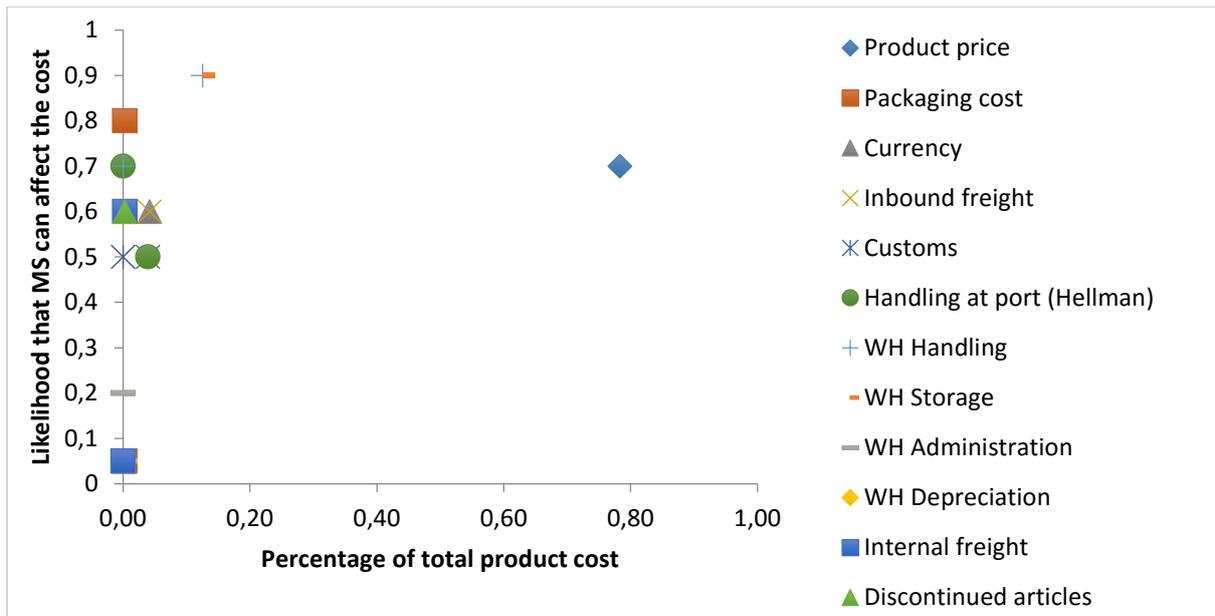


Figure 29 Cost element analysis

When the four cost elements were selected the drivers connected to these were divided into three categories:

1. Drivers affecting 3-4 of the cost elements
2. Drivers affecting 2 of the cost elements
3. Drivers affecting less than 2 of the cost elements

It was assumed that the cost drivers driving several of the prioritized cost elements would be more complex to investigate and therefore require more time than some of the cost drivers connected to less cost elements. The aim of a further investigation was to properly assess in what way the cost drivers affected the four prioritized cost elements, and thereby how the cost elements should be calculated in the cost model. Since the time frame was already limited some prioritizing was also needed for the cost drivers. The cost drivers in category 1, affecting 3-4 of the prioritized cost elements, are listed below. These cost drivers were then discussed in workshop 1, see section 7.1.1 *Workshop 1*, where further decisions were made.

- MOQ
- Number of articles
- Supplier location (Asia/Europe)
- Order structure
- Scrapping process
- Inventory turnover
- Promised delivery reliability
- Bonus programs/KPIs
- Sales estimates
- Sales incentives
- DOI – Days of inventory

## Appendix 6

### Warehousing Storage Cost

Calculation steps in the average stock level formula to be able to use this formula:

$$\text{Average stock level} = \frac{Q}{2} + S,$$

$$Q = \text{order quantity}, \quad SS = \text{safety stock}$$

Order quantity, Q

$$Q = \frac{\text{sales estimation per year}}{\text{number of orders per year}}$$

Number of orders per year

Duni uses the following intervals for their orders:

Order frequency	Number of orders per year
Once a week	52
Every second week	26
Once a month	12
Once every second month	6
Once every six month	2
Once a year	1

Based on the MOQ and the sales estimation that the user fills into the model, an estimated inventory turnover ratio is calculated.

$$\text{Estimated inventory turnover ratio} = \frac{\text{sales estimation per year}}{\text{MOQ}}$$

This estimated inventory turnover ratio is then compared to the table above in order to find out how the estimated order frequency will look like for the specific product. I.e. if the estimated inventory turnover ratio is calculated to be 16, the number of orders per year is estimated to be 12 times, since the MOQ will make it non-beneficial to order more often than this, and 12 is then used to calculate Q. However, if the estimated inventory turnover ratio is lower than 1, the model will still assume that Duni will order once a year.

Safety stock, SS

The safety stock at Duni is calculated with the following formula based on the lead-time of the product:

$$SS = (\text{supplier lead time})^{0,85}$$

This formula is about to be updated during 2016, and the new formula should be put into the model when ready.

## Appendix 7

### User Guide – Cost Model

The purpose of the model is to get an understanding of the true costs connected to a product and to be able to compare different sourcing alternatives. In this user guide it is described how to use the model and what results that comes out of it. The model can be used for one product at a time or up to 1500 products if a whole assortment should be analyzed. However, at the analysis-sheet only three different cases can be analyzed at a time.

#### Sheet 1 – USER PAGE

This is the page where the in-data comes in – filled in manually by the user. The yellow fields are the ones that need to be filled in with information.

The yellow fields contain the following parameters:

- **Alternative description** – a name of the alternative, to be able to track the results. Could for example be the article number or the supplier name.
- **Supplier MOQ** – the minimum order quantity set by the supplier, in pieces.
- **Product price** – the purchasing price including packaging cost per 1000 pieces.
- **Price unit** – the unit of which the purchasing price is in. Input should be “EUR” or “USD”, notice the capital letters.
- **Currency factor** – the current currency factor between EUR and USD, from EUR to USD. Today’s factor can for example be found at [www.valuta.se](http://www.valuta.se)
- **Sales estimation** – the total estimated sales volume per year, in pieces/year.
- **Supplier in Asia?** – whether the product is sourced from Asia or not. Input should be “Yes” or “No”, notice the capital letter.
- **Plastic product?** – whether the product is a plastic product or not. Input should be “Yes” or “No”, notice the capital letter.
- **Lead time** – the supplier lead-time in days.
- **Sales price** – if it is a new product this is the estimated sales price of the product, for an old product this might be ASP or Net ASP (average sales price). The unit is per 1000 pieces.
- **Number of pieces per pallet** – as it sounds, how many pieces that will be transported on one pallet.

#### Sheet 2 – Results

In this page the results are shown in numbers. No editing can be done in this page – only copying of the results.

The result columns consist of the following results:

- **Alternative description** – the description of the alternative, put into the user page by the user. To be able to track the specific alternative.
- **CB1 €** – the first level margin, a comparison of the sales price contra the product price, freight cost and custom duties. Presented in Euro.
- **CB1 %** – the same as above but as a percentage instead, showing the relation between CB1 € and the expected income of the product (based on the sales price and the sales estimation).
- **CB2 €** – the second level margin, a comparison of the sales price contra the total cost calculated in this model. The total cost includes all costs from the point where Duni takes over the

ownership of the product to when it will leave the warehouse to the customer. The freight cost out to the customer is not included in the result. The value is shown in red, if negative result.

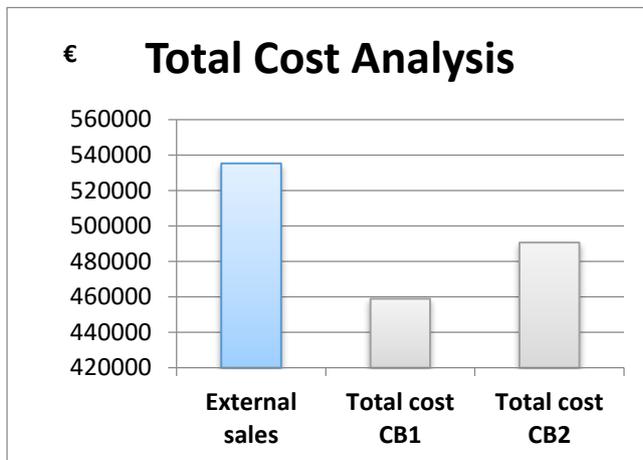
- **CB2 %** – the same as above but as a percentage instead, showing the profit margin of the product. The value is shown in red, if negative result.
- **Total cost (per year)** – the total cost of a product per year, including all costs included in this model.
- **Total cost (per 1000 pieces)** – the total cost of 1000 pieces of a product, including all costs included in this model.
- **Inventory turnover ratio (times per year)** – how many times **per year** that a total turnover of the inventory (for the product) is expected to occur. The current Duni accepted minimum is 4, why the model will return a red answer if the value is below this level.
- **Currency risk percentage** – the risk if the product is sourced in USD and the currency factor back to EUR would be the worst-case scenario.

*Notice: the costs do not include costs as direct selling cost, outbound logistics or growth bonuses, which means that the result in all cases will be “even worse (higher)” in the reality. This means that the total costs in this case only gives an indication of how the true costs look like and where the total margins are low they would likely be even lower in the reality.*

### Sheet 3 – Analysis

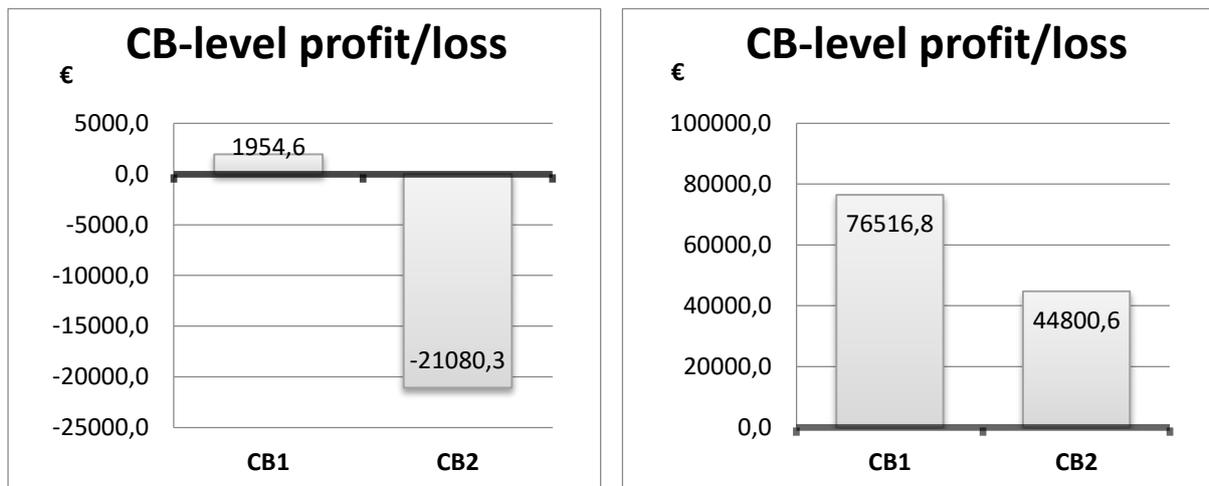
In this sheet various analysis and graphs are presented as shown and explained below. By scrolling right in the sheet the data/numbers behind the graphs can be found.

#### Total cost analysis



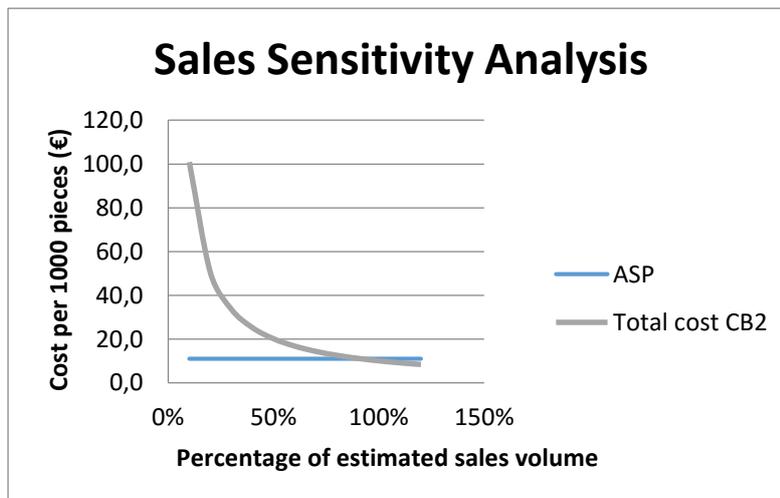
This graph shows the external total sales compared to the total cost at CB1 and CB2 level. This shows the relation between them and how they might differ.

## CB level analysis



Shows the relation between the CB1-level and the CB2-level. Could be both positive and negative results. If negative CB2-level (or CB1): Look at the cost share analysis (in the last graph) to find if there are areas that might have potential for cost reductions. Otherwise, the sales price probably needs to be increased, in order for the product to be profitable.

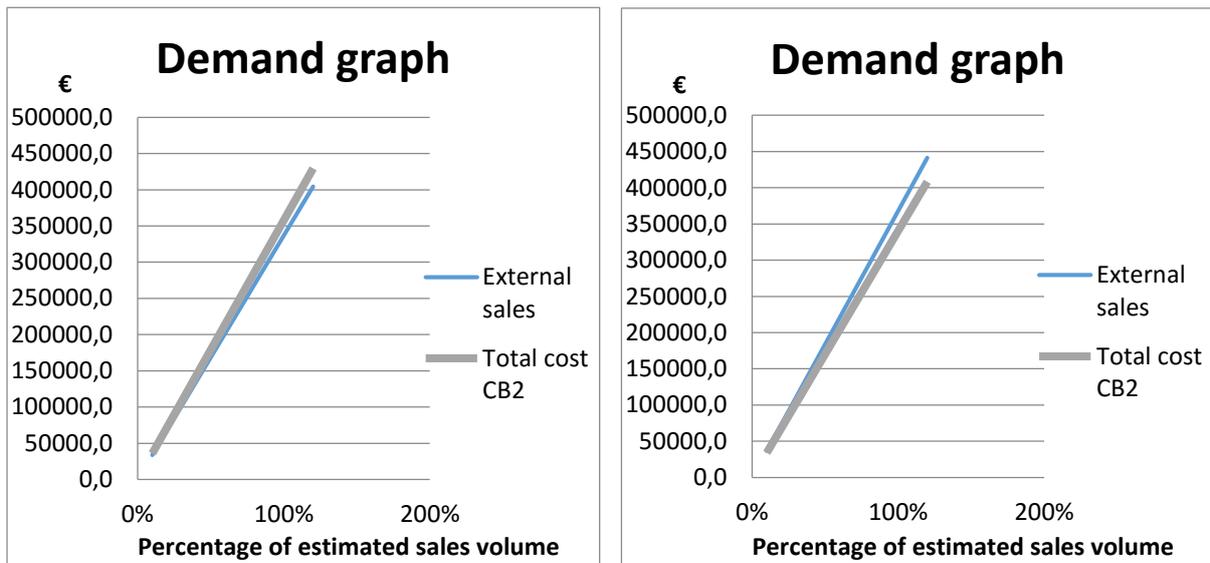
## Sales sensitivity analysis



This graph is a sales sensitivity curve that shows how the cost would change if the actual sales volume would differ from the estimated sales, assuming that the estimated sales volume is purchased by Duni. This could give an indication that the product includes a large sales risk depending on when the cost and price curves intersect.

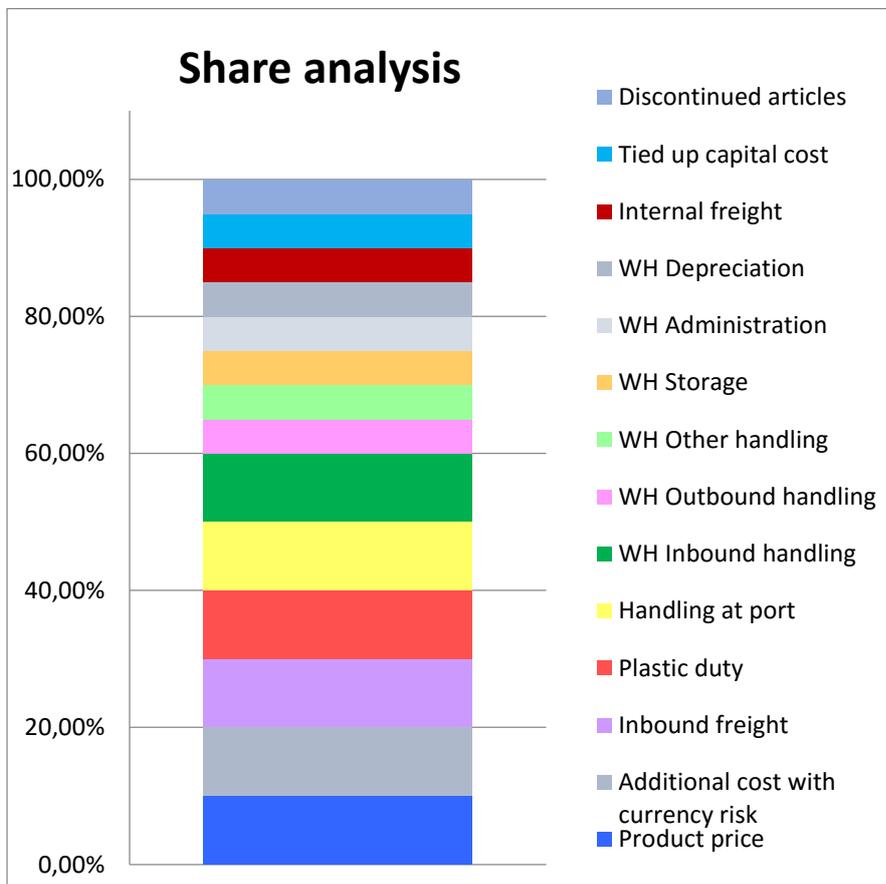
- If the curves intersect at exactly 100% it means that if anything less than the expected sales volume will be sold, the product will have a negative result (meaning that the total cost will be higher than the sales price).
- If the curves intersect at 50% this means that the product still would be profitable (or plus minus zero) as long as at least 50% of the estimated sales volume would be sold.

Demand analysis



This graph shows the relation between the sales volume and the total cost of the product, assuming that the volume purchased by Duni follows the actual sales volume. If the outcome is as in the first graph above, the total cost will always be higher than the external sales, despite the sales volume. Then the sales price needs to be increased, or costs tried to be reduced, in order to make the product profitable.

Share analysis



This graph shows the relation between all costs within the total cost of a product. The various colors stand for different costs, explained in the right side of the graph. Here the purpose is to show the share that each of the costs has of the total cost. This is what the various costs mean and examples of what actions that could be taken to try to minimize them (if one specific cost is considered too high):

- **Product price** – the price paid to the supplier, including the packaging cost.
  - Actions:
    - Negotiation with supplier
    - Change supplier
- **Additional cost with currency risk** – the cost that will be added to the cost if the currency will get down to the worst-case scenario.
  - Actions:
    - Be aware of the risk this includes
- **Inbound freight** – the freight from the supplier to Duni, with either ship or truck.
  - Actions:
    - Change carrier if possible
    - Move to European supplier
- **Plastic duty** – extra duty on plastic products from Asia.
  - Actions:
    - Move to European supplier
- **Handling at port** – the cost of reloading and palletizing goods arriving from Asia.
  - Actions:
    - Move to European supplier
- **WH Inbound handling** – handling cost in the warehouse when taking care of incoming goods.
  - Action:
    - Optimize the order pattern from suppliers
    - Order only full pallets
    - Better packaging solutions
- **WH Outbound handling** – handling cost in the warehouse when picking, packing and loading outgoing goods. Also to take care of claims and returns.
  - Action:
    - Optimize the customer order pattern, only full outgoing pallets if possible
- **WH Other handling** – other handling cost in the warehouse such as administration.
  - Action:
    - Have an overall look at the order pattern, optimize as much as possible
- **WH Storage** – cost per pallet place in the warehouse, higher if the days in inventory is long
  - Action:
    - Try to increase the inventory turnover
    - Decrease the MOQ if possible
- **WH Administration** – administration cost in the warehouse, fixed
- **WH Depreciation** – depreciation cost on the warehouse, fixed
- **Internal freight** – transportation costs between Duni warehouses
- **Tied up capital** – cost of tied up capital during transport etc.
  - Action:
    - Decrease the purchasing price and this will be lower
- **Discontinued articles** – the cost of all discontinued/obsolete articles still in the warehouse
  - Action:
    - Look through the assortment and the stock levels in the warehouse to see what products that can be sold out or scrapped
    - Make sure to not purchase too high volumes of products if there is a risk that not all of them will be sold

## Appendix 8

### Sensitivity Analysis

In the sensitivity analysis the input parameters were changed according to Table 33. In the table it can also be seen what the result was expected to be and if we sometimes noticed that the result was another, some changes were made in the model until we got the wanted results.

Parameter	Action	Result
MOQ	Increase/decrease	When ↑ Storage cost increased Total cost increased The margins decreased When ↓ Storage cost decreased Total cost decreased The margins increased
Purchasing price	Increase/decrease	When ↑ Total cost increased When ↓ Total cost decreased
Price unit	Varying between USD/EUR	When USD: the purchasing price should be recalculated to EUR When EUR: the purchasing price should remain the same as the input
Currency factor	Put in various numbers	Make sure that the purchasing price was divided by the right number (when USD as price unit) and that the total cost changed accordingly
Sales estimation	Increase/decrease	When ↑ Make sure that all costs increased individually and as a total When ↓ Make sure that all costs decreased individually and as a total
Supplier in Asia?	Varying between Yes/No	When Yes: the Asian freight cost should be used, the total cost thereby increased When No: the EU freight cost should be used, the total cost thereby decreased
Plastic product?	Varying between Yes/No (combined with the supplier in Asia parameter)	When Yes combined with supplier in Asia: make sure that the additional plastic duty cost was added and that the total cost was increased Other cases: make sure that the plastic duty was not added and that the total cost remained unchanged
Lead time	Put in various numbers	Make sure that the correct expected DOI was selected and that the storage cost changed accordingly The total cost should increase with higher lead time (since the SS then will be higher and the storage cost higher)

Sales price	Increase/decrease	When ↑ The margins increased When ↓ The margins decreased
Number of pieces per pallet	Increase/decrease	When ↑ Total cost per piece decreased When ↓ Total cost per piece increased

Table 33. The sensitivity analysis.

In the cases where we increased and decreased the numbers we checked that the result increased/decreased accordingly. However, we also multiplied and divided the numbers with a factor to make sure that the results also were adjusted not only in the right direction but also with the correct amount.