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Master's thesis

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Production unit's overhead cost allocation with activity-based costing in food industry enterprise

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ABSTRACT

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The main objective of this Master's thesis is to develop a cost allocation model for a leading food industry company in Finland. The goal is to develop an allocation method for fixed overhead expenses produced in a specific production unit and create a plausible tracking system for product costs. The second objective is to construct an allocation model and modify the created model to be suited for other units as well. Costs, activities, drivers and appropriate allocation methods are studied.

This thesis is started with literature review of existing theory of ABC, inspecting cost information and then conducting interviews with officials to get a general view of the requirements for the model to be constructed. The familiarization of the company started with becoming acquainted with the existing cost accounting methods. The main proposals for a new allocation model were revealed through interviews, which were utilized in setting targets for developing the new allocation method.

As a result of this thesis, an Excel-based model is created based on the theoretical and empiric data. The new system is able to handle overhead costs in more detail improving the cost awareness, transparency in cost allocations and enhancing products' cost structure. The improved cost awareness is received by selecting the best possible cost drivers for this situation. Also the capacity changes are taken into consideration, such as usage of practical or normal capacity instead of theoretical is suggested to apply. Also some recommendations for further development are made about capacity handling and cost collection.

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Tämän diplomityön päätavoitteena on kehittää tuotekustannuslaskentamalli yhdelle Suomen johtavassa asemassa olevalle elintarvikealan yritykselle. Tavoitteena on kehittää kustannusten kohdentamismenetelmä, jonka avulla voidaan seurata tuotantoyksikön kiinteiden kustannusten vyörymistä. Toinen tavoite on rakentaa kehitetty malli ja soveltaa se yrityksen muihinkin yksiköihin sopivaksi. Mallin rakentamiseksi selvitetään kustannuksia, tarkastellaan toimintoja ja tutkitaan sopivia menetelmiä kustannusten kohdistamiseen.

Tutkimus toteutetaan kartoittamalla toimintolaskentaan liittyvää kirjallisuutta, tarkastelemalla yrityksen kustannustietoja ja haastattelemalla yrityksen avainhenkilöitä. Haastattelemalla pyritään selvittämään yrityksen avainhenkilöiden toiveet mallin rakentamista varten. Yritykseen tutustuminen aloitettiin kustannusjärjestelmien tutkimisella. Mallin päätavoitteet saatiin selville haastattelujen avulla, jotka huomioitiin mallin rakennuksen tavoitteita asettaessa.

Tutkimuksen tuloksena luodaan teoriaan ja empiriaan perustuva Excel-pohjainen tuotekustannuslaskentamalli. Uusi laskentamalli käsittelee kustannuksia tarkemmin lisäämällä kustannustietoutta ja läpinäkyvyyttä kustannusten vyörytyksissä sekä havainnollistamalla tuotteiden kustannusrakennetta. Lisääntynyt kustannustietous saavutetaan löytämällä sopivimmat kustannusajurit. Myös kapasiteetin huomioimiseen otetaan työssä kantaa suosittelemalla käyttämään käytännön kapasiteettia tai normaalia kapasiteettia teoreettisen sijasta. Lisäksi työssä esitetään kehitysehdotuksia kapasiteetin käsittelystä ja kustannusten keräämisestä.

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Lappeenranta, May 2015

Jonna Suutari

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1 INTRODUCTION

1.1 Backgrounds

The meaning and importance of cost accounting methods has increased since the mid-1970s. Global environmental awareness and global competition have led companies to think of new possibilities to handle their costs in a better way (Kaplan and Cooper 1998, vii, 1). The need for surviving in the modern day competition has led the companies to survey their own costs. The importance of recognizing the accurate, correct and defective information is the starting point in staying in the competition. (Turney 1994, 9)

In the global economy companies have recognized that the managers do not get proper types of information or the required level of details needed to make good business decisions with their traditional overhead allocation systems (Barfield et al. 1994, 165). The companies' need for more operational information on their activities has created a transformation in the cost accounting needs (Turney 1994, 82). In today's business a dramatic shift has taken place in the components of product costs: the overhead portion of product cost has increased significantly because less labor and more machines are involved in the production process. **(**Barfield et al. 1994, 6, 165-165**)** When companies want to have full costing system also overhead costs have to be allocated to the product costs. They are hard to allocate because overhead costs are costs that are related to the cost object, but cannot be directly traced to the cost object (product). (Caplan 2006, chapter 8)

A change in a company's cost accounting is usually the starting point in updating the cost methods **(**Gunasekaran and Sarhadi 1998, 231) Especially in VAASAN Oy the process of updating the cost method is a result of a need to allocate overhead costs to products and to understand in a better way the costs incurred within processes (Lauri 2014). In this case, when discussing fixed costs, the costs that are referred are production unit overheads that consist of fixed costs incurred within the production unit (see **appendix 1**). Therefore, the need for better accounting methods has increased, the need is to explore different methods, definitions and issues in the field of cost accounting.

This thesis is made for a Finnish bakery company, VAASAN Oy, which is a part of VAASAN Group. VAASAN Group is one of the leading bakeries in the Nordic area. VAASAN Group operates in seven different Nordic countries including all the Baltic countries providing various types of bakery products. VAASAN Group has different brands in different countries, for example in Sweden the best known brand is Bonjour. In this thesis the bakery company is studied trough one production unit which has different levels of activities. This thesis is motivated by the practical needs of the company to develop a new accounting method for fixed costs. The managers are interested in a deeper knowledge in cost allocation between the companies, business areas, units and products within the units. In this thesis the costs are studied on a production unit level.

1.2 Goals and restrictions

The purpose of this thesis is to create a cost allocation model for the bakery company. The aim is to create a model to allocate fixed overhead costs by which the company can manage the costs in a better way: to create a more detailed costing system by following IFRS. The International Financial Reporting Standards require that the production's overhead costs are included in the stock value of the products. Therefore the model is constructed in a way that it comply the principles of IFRS. The applied principles are listed in **appendix 2**.

The main research question in this thesis is:

- What kind of product costing model could be created for allocating fixed overhead costs in a food industry business?

The main question is divided into three sub questions:

1. From which elements should the model consist of and what methods could be utilized following the rules of IFRS?
2. What are the main drivers to be used in the allocation process?
3. What is the most accurate reference period for the costs?

The allocation model created should include allocation methods, including cost drivers and activities. The allocation model created should be based on the needs of the company and the limited information available. This thesis initiates by seeking the needs of the company and the set definitions of the end results of the model.

In this thesis the main restriction on the allocated costs is based on the IFRS. According to IFRS only some specified overhead costs are allocated to products: direct costs related to production, costs of purchase net of trade discounts received and production unit overheads including fixed wages, rents and depreciation, for instance. Therefore in this thesis the costs are allocated with limitations, such as that the unit cost will not include overall marketing or sales costs and that also research and development (R&D) is excluded. The allocation will give the company value-added information about the cost pools in different units. For that reason the allocation process is discussed with the limitations of this thesis.

As a result, the allocation model will be built for the needs of the company, in order to define costs within different units. However, the fact that the units are not alike and processes differ between them, will create difficulties. Using the model to create more precise information, the company can make better and more accurate business decisions in the future. This will create added value for the company. Also the future invests are easier to be decided and new products can be added with more information to support the decisions. This type of a model is new for the company in case and it is interesting to see how easy it is to build and what sort of additional limitations will occur during the process.

1.3 Research methods

Thesis is concluded of two different parts: theoretical study and empirical study. In the theoretical part of the study different cost systems are studied to create a guideline for this thesis. The theoretical part is executed as a literature review to create general overview of the possible solutions and to create guidelines. The aim of literature review is to find out previously made research of the subject and position the research as a part of a larger study unity (Hirsjärvi et al. 2009, 121). In chapters 2 and 3 the literature review aims to analyze previous researches with a critical perspective, so that the reader may have enough knowledge about cost accounting in general before the actual empirical study. Literature review can be performed with different kinds of methods: descriptive review, systematic review and meta-analysis. In this thesis the literature review is made as integrative review, which is classified as a descriptive research method. Integrative review aims to describe the research problem with diversity. (Torroca 2005, 356; Salminen 2011, 6-9)

The aim in the empirical part of this thesis is to find and create a suitable outcome for the research and sub questions above. The empirical part is executed as a constructive-type study. The aim of constructive study is to create a solution to a problem by constructing model or blueprint, for example. (Kasanen et al. 1991, 305). Construction in this thesis is created by using the existing theory to provide a concrete end result: a working model for allocating fixed overhead costs for the usage of the case company. The construction is realized with modeling. The empirical data is collected by studying the provided accounting information and conducting some interviews. The interview has the advantage that it can be adjusted with the requirements of the situation. The interview is often chosen because the interviewee is seen as the objective of the study situation. (Hirsjärvi et al. 2009, 205)

In this thesis, the methods employed to gather data are interviews and inspection of cost information. The empirical data utilized in this thesis are collected from three selected production units by interviews and cost collection of the data system used in the company. The empirical data, mainly collected from the data system, is then discussed using interviews with few selected controllers, production unit managers and production planners. They are interviewed to get more information about activities and drivers suitable for allocating the costs. Later this collected information is used to build a product costing model to calculate production unit's overhead costs to individual products. Whether the created model really works in the end will be tested on the selected subject units. Based on this thesis the end results cannot be generalized because of the limited amount of research subjects.

1.4 Structure of thesis

This thesis consists of seven chapters. Chapter 1 is introduction where the study's background, goals and restrictions, research questions, methods and structure are introduced. Chapters 2 and 3 consist of theory on product costing. In chapter 2 different cost definitions and their behavior in cost accounting are introduced. Unused capacity and depreciation have been introduced more thoroughly as an example. The main characters of ABC and tools to be used in product cost accounting are presented in chapter 3.

The empirical part of the study is introduced in chapters 4 and 5. Chapter 4 introduces the case company and chapter 5 discuss about the allocation model to be created. The main issues are the formation of product costing model and finding the most suitable activities and drivers forming the cost allocation method based on them. Results of the findings are presented on chapter 6, which collects all the main results and creates discussion. Finally, chapter 7concludes a short summary of the main contents of the thesis. A more specified structure of the thesis is presented in **figure 1**.

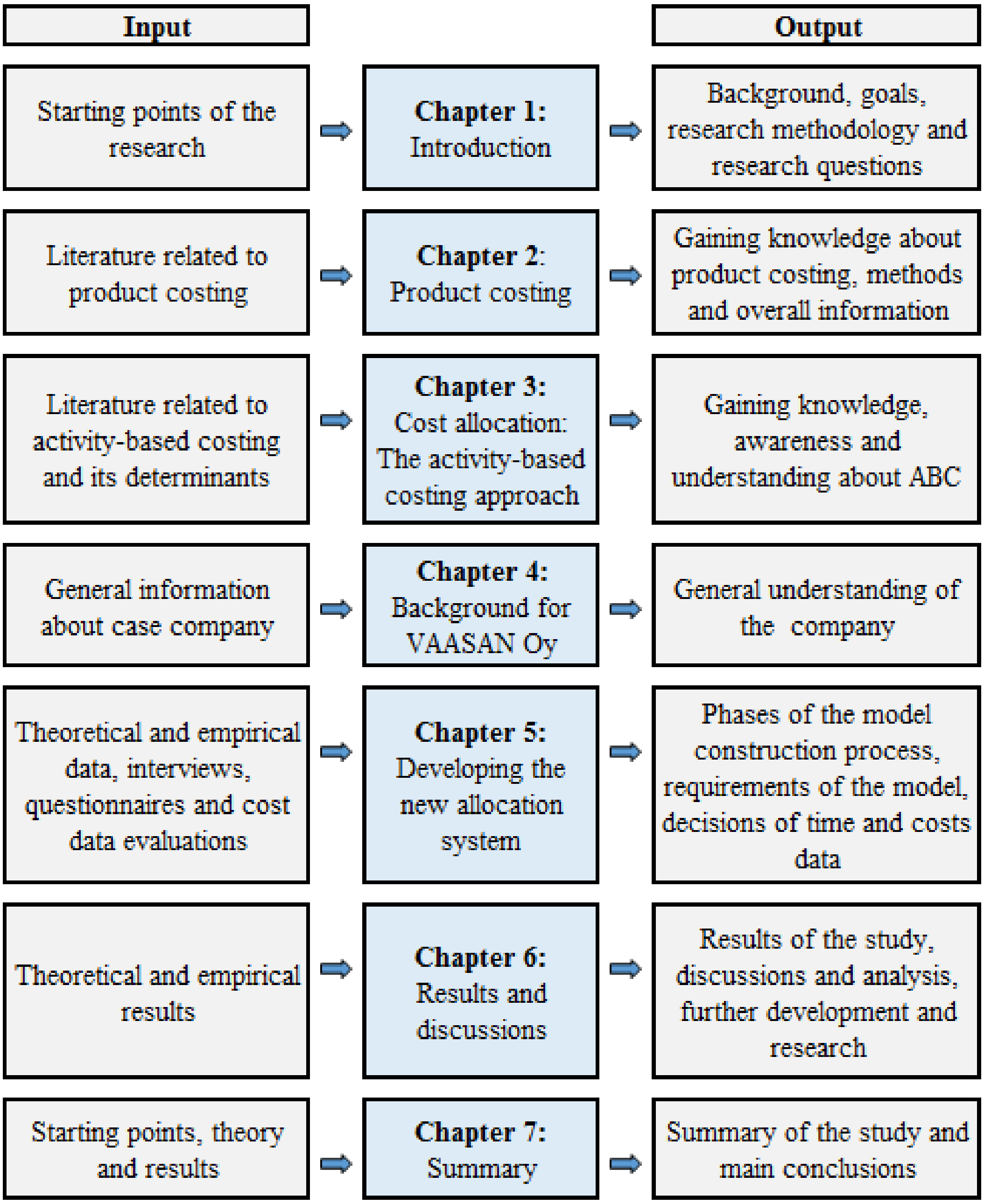

Figure 1. Structure of this thesis.

2 PRODUCT COSTING

2.1 Definitions and cost behavior

Accountants' definition of costs is described "*in terms of historical value of economic resources used as a result of producing or doing whatever is being costed*" (Jegers et al. 2002, 681). However, costs can be defined and approached in many different ways (Lovins & Lovins, 1991; Brown et al., 1998; Azar and Dowlabadi, 1999; Carraro et al., 2003; Horngren et al. 2005). For example, economists define costs as resources which have been sacrificed to achieve a specific target or object. Usually costs can be broken down into two cost elements: a price of resource and a quantity of resource used. Based on accountants' definition a formula for cost can be formed: cost = usage x price. (Jegers et al. 2002, 681; Horngren et al. 2005, 27)

In cost accounting the terminology is used for different concepts. Traditionally costs are divided into fixed and variable costs. Company's level of activity determinates whether the cost is direct or indirect. *Variable costs* are costs that change when company's level of activity changes whereas fixed costs remain intact. Typical examples of variable costs are material used in production and energy. Typical *fixed costs* are typically called production's overhead costs and they consists of costs such as rents, wages of management and administration, depreciation and insurances. These costs are fixed because they are not dependent on changes of level of activity and therefore are untraceable. (Barfield et al. 1994, 37-38; Horngren 2005, 496; Jegers et al. 2002, 681)

As is shown in **figure 2** the cost of a cost object consists of different parts: variable and fixed costs. When determining the *full cost* of cost object (or *absorption cost)*, the indirect costs are to be added to the direct costs by allocation. Because the relationship between cost object and indirect costs is rather loose, a specific method called activity-based costing (ABC) can be applied to help tracking the relation between costs and cost object. (Jegers et al. 2002, 681) Most companies allocate fixed costs to products to determine their full cost when setting list price (Balkrishnan and Sivaramakrishnan 2002, 3) or for making product portfolio decisions (Cooper and Kaplan 1988, 96). While allocating one must remember that only the costs that the object creates can be allocated. (Barfield et al. 1994, 560-561) In this case the indirect costs are to be allocated because of the need for harmonization and legislation.

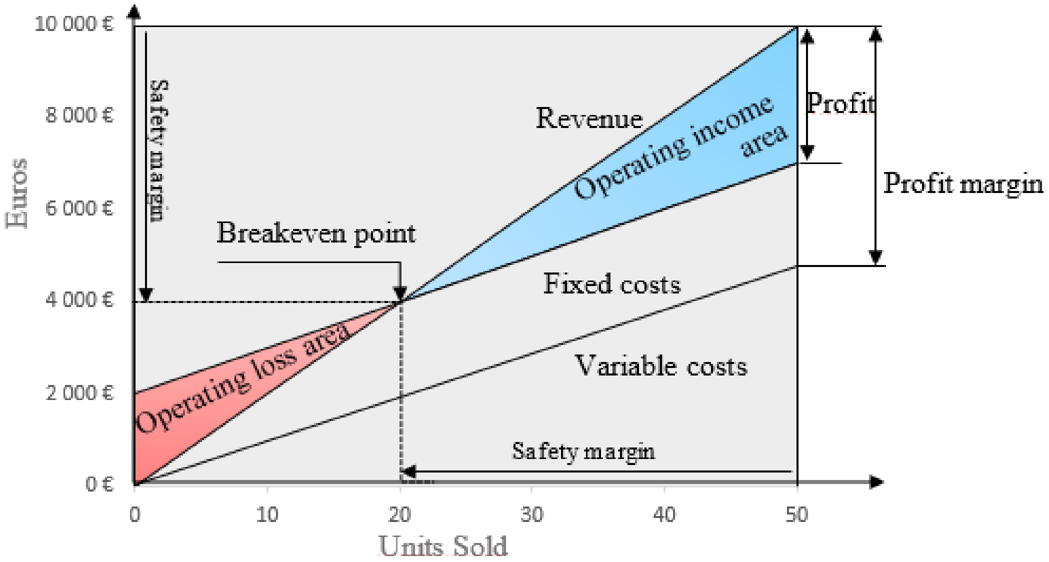

Figure 2. Cost-volume-profit (Horngren et al. 2005, 64).

2.1.1 Capacity

Capacity is the facility's maximum rate of output (over a specified period of time) and it has five different definitions based on the type: theoretical, practical, normal, budgeted and actual utilization of capacity, although the number and naming of the capacity types differ along the writers (e.g. Krajewski & Ritzman 1999). *Theoretical capacity* is a manufacturer's level of production that would be attained if all of the equipment and operations performed continuously at their optimum efficiency 24-hour, seven-day a week with zero waste. This capacity is, however, not realistic due to repairs, maintenance, setups, holidays and other factors that may influence the perform time. (Krajewski & Ritzman 1999, 300; McNair & Vangermeersch 1998, 27-28)

Practical capacity is the level of a manufacturer's level of output that is less than theoretical capacity, and generally attainable by a process. Practical capacity takes repairs, maintenance, setups, plant shutdowns for holidays, and other downtime into consideration which is why practical capacity is lower than theoretical. Practical capacity, however, does not mean that the manufacturer's annual output to meet its sales orders is the same as capacity. (McNair & Vangermeersch 1998, 28)

Normal capacity is the average and expected state of production and utilization of machine and process over a defined period of time whereas *budgeted capacity* is the wanted and planned state of utilization of machines. The fifth type of capacity is *actual capacity* which is the capacity used during the period production. Actual capacity measurements are the least informative while creating cost estimates for capacity. (McNair & Vangermeersch 1998, 28)

Usually companies' problems lies with acquisitioning (or reducing) the capacity to match the demand. (Olhager & Johansson 2012, 23) A company's capacity is usually linked into three factors: a certain amount of resources, the usage of resources or man or machine based and a defined amount of costs caused by usage of resources. The usage can differ between days and months depending usually of call or demand (of orders). Because of the variation in the demands the usage of capacity differs and so for creates costs of unused capacity. (Uusi-Rauva et al. 1994, 34, 36; Cooper and Kaplan 1992, 2) Whether the unused capacity is caused by the produced or not produced products is yet to be solved (Paranko 1996, 469).

2.1.2 Depreciation

Depreciation can be identified as an indirect cost of a production unit. Depreciation is not a valuation but a cost allocation and it can be defined as an accounting process of allocating the cost of tangible assets. These costs are allocated to expense in a systematic and rational manner to those periods expected to benefit from the use of the asset. Generally depreciation is a computation of the periodic charge to be allocated to the cost of products by the amount of revenues reported in each period. Before depreciation can be allocated three certain estimates have to be made: 1) valuate the assets, 2) determine the assets' expected service life and 3) estimate the scrap value at the end. (Paranko 1996, 469, 472)

Depreciation can be allocated in different ways depending on the purpose or importance of different factors. For instance, if physical factors are important, an activity-analysis and ABC could be used. If the costs are more of a machine utilization related, the difference between unused machine hours and utilized hours should be included. (Paranko 1996, 472) In the case company the depreciation is not dependable on machine utilization, but because the case company's depreciation is more linked to the machinery than buildings and such, the allocation of depreciation costs could be based on machine utilization.

2.2 Development of product cost systems

The definition and the base of cost accounting first appeared in literature in 1928 (Näsi 1987, 44-45). Since, cost accounting and different systems have been developed to support it. In 1980s the information technology became a part of cost accounting and from then on accounting and information technique started to merge. Especially different supporting systems, such as ERP (Enterprise Resource Planning) and SAP, became a part of accounting. (Näsi 2006, 64)

Since the first appearance of cost accounting, different methods have occurred. Especially product cost systems have developed into different directions. There are different methods for product cost accounting: standard costing, job-order costing, target costing and activity-based costing, for instance. All of these methods can and have been used in managerial cost accounting. (Kaplan and Cooper 1998, 3) The last mentioned, activity-based costing, was developed because of the problems noticed in traditional cost accounting methods. The one and the same problem has occurred trough out the cost accounting systems: the validity of accounting is nearly impossible to prove. (Uusi-Rauva et al. 1994, 20-21) ABC was developed to correct the problem and invent a solution to it by creating a new type of cost accounting method (Cooper and Kaplan 1988, 96-98). Even though development has taken place throughout business, it has not been in the same stage in all of the business areas. In food industry the development of cost systems has been a little slower than in other business areas. (Mann et al. 1999, 18)

The cause for low financial returns in food industry is considered to be a result of companies' appliance of traditional methods. Also not learning from the experience of best-in-practice companies, and not applying a systematic approach to achieving business improvement have been considered to be reasons for low financial returns. Food industry is a difficult industry to work on, because many products within the food industry have a limited shelf life. This adds pressure on all operations and has an important influence on managers' decision-making. (Abdel-Kader and Luther 2008, 6, 10) However, according to Mann et al. (1999, 18), companies in food industry do not have as developed management systems as other industries, because they have no insight in using appropriate non-financial indicators at meeting financial targets and are rare to benchmark their results.

According to Abdel-Kader and Luther (2006), the companies in food industry are aware of the importance of overhead allocation techniques but they do not believe that it is worth implementing them regularly. In ad hoc decisions managers rely solely on direct and variable costs and they do not see costing of quality as something to be measured frequently. (Abdel-Kader and Luther 2006, 338, 340) Because the performance of the companies should be measured with financial and non-financial measures, VAASAN Oy is improving its cost allocation system by implementing ABC to get better information on production unit's costs.

2.3 Different costing systems

According to Caplan (2006), product costing is a cost accounting system which builds up the cost of product with direct costs that can be traced to the product and overhead costs which are allocated to the product. Product costing follows these five steps:

1. Identify the cost object (for instance product/service)
2. Identify the direct costs associated with the cost (for instance direct material cost)
3. Identify overhead costs (for instance maintenance costs)
4. Select the cost allocation base (for instance number of machine hours)
5. Develop the overhead rate for allocating overhead to the cost object. (Caplan 2006, chapter 8)

There are several different costing systems to select from, when deciding to allocate costs to products. The most known are the following five methods: standard costing, target costing, process and job-order costing, life cycle costing (LCC) and activity-based costing. Standard costing is the existing method for the case company and activity-based costing is a new method that will be introduced to the company. The purpose for using introducing ABC, is to improve the current cost accounting system and complement the current method by including overhead costs to calculations. For those reasons the main characters of standard and activity-based costing are introduced shortly.

2.3.1 Standard costing

Standard costing is one of the most known and widely used product costing systems. Standard costing was developed for the needs of a traditional production environment which differ significantly from the needs of a modern days' production environment. This costing system suits best an organization whose activities consists of a series of common or repetitive operations and the input required to produce each unit of output can be specified. Standard costing is also suitable for organizations that produce many different products with a series of common operations. Standard costing is a widely used accounting system because it can create information for a lot of purposes: decision-making purposes, providing challenging targets to achieve, assists on setting budgets, acts as a control device by highlighting unwanted activities and simplifies the task of tracing costs to products for profit measurement and inventory valuation purposes. (Drury 2004, 725–726, 733–735)

Standard costing bases on standards: *a standard* is a budgeted amount for single unit of output, when *a standard cost* for one unit of output is the unit's budgeted production cost. Standard costing uses these standard costs in practice to report the difference between an expected cost and an actual cost. (Caplan 2006, chapter 10) Standard costs are typically directed to the product with production costs – raw material, direct labor hours and different kinds of overhead rates. Usually these standards are used in monitoring the production efficiency. Standards usually have a positive impact on organizations outcome by improved decision making process. (Neilimo and Uusi-Rauva 2010, 172-174) There are several advantages and disadvantages of using standard costing listed in **table 1**.

Table 1. Advantages and disadvantages of standard costing (Caplan 2010, chapter 10; Horngren et al. 2005, 257-258; Fleschman et al. 2008, 344).

Advantages	**Disadvantages**
- Cost control Standard costing system records both budgeted and actual costs incurred. The analysis between these costs creates additional cost control information.	- Consumes resources Standard costing system may be in some cases very expensive, tedious and time consuming to implement and update.
- Smooths out short-term fluctuations in direct costs The cost differences between days purchase price are averaged out in direct costs. The production does not have to trace different days' different purchase prices to the products produced.	- Does not automatically update standards When production environment changes, standards are still the same unless they are not manually updated. That way the standards may give false information. Updating creates additional costs.
- When using overhead rates, production volume of each product affects the reported costs of all other products	- High degree of skill Standard costing system and updating it requires high degree of skill.
- Costing systems that use budgeted data are economical In many cases, standard costing systems provide highly reliable information, and for that reason the additional cost of operating an actual costing system is not warranted.	- Standards are dependable on size of a batch When batch size differs significantly from standard, products actual costs change. In serial production standards may differ between batches in a way that cannot be predicted. The accuracy of calculation may suffer.

At the moment VAASAN Group applies a modified version of standard costing for calculating variable costs for their product costs. However, when calculating production overhead costs, standard costing is not the most suitable costing method. Because the new product costing method for overhead costs needs to be easy to update and light in structure, standard costing is too heavy of a method and therefore activity-based costing is introduced to be used.

2.3.2 Activity-based costing

ABC was created in the 1980s because the need to improve and update cost systems became relevant, the competition between companies globalized and at the same time products' life-cycle took major improvements and increased production's overhead costs. These actions created changes and inaccuracies in the product costing. (Kinnunen et al. 2006, 85–86) The aim in ABC is to find a relation between products and costs. The object is to create a fair correlation in allocating costs and resources to products according to the use and need. (Neilimo & Uusi-Rauva 2010, 144, 153)

Activity-based costing is a cost accounting system that estimates the cost of resources *used* in organizational process while producing outputs, products (Cooper and Kaplan 1992, 1; Kinney and Raiborn 2009, 100). ABC is created out of three fundamental components: recognizing that costs are incurred in different organizational levels, accumulating costs into related cost pools, and using cost drivers to assign costs to products and/or services. (Kinney and Raiborn 2009, 111)

In more thoroughly explained ABC is a two dimensional costing model which consists of allocating the costs and monitoring the process. As seen in the **figure 3** the vertical axis describes the first dimension: the company's need to allocate the costs to activities and cost objects. This dimension creates companies an opportunity to be able to analyze important decisions. These could be for example decisions about product pricing, range of products and prioritizing the issues. (Turney 1994, 82-83)

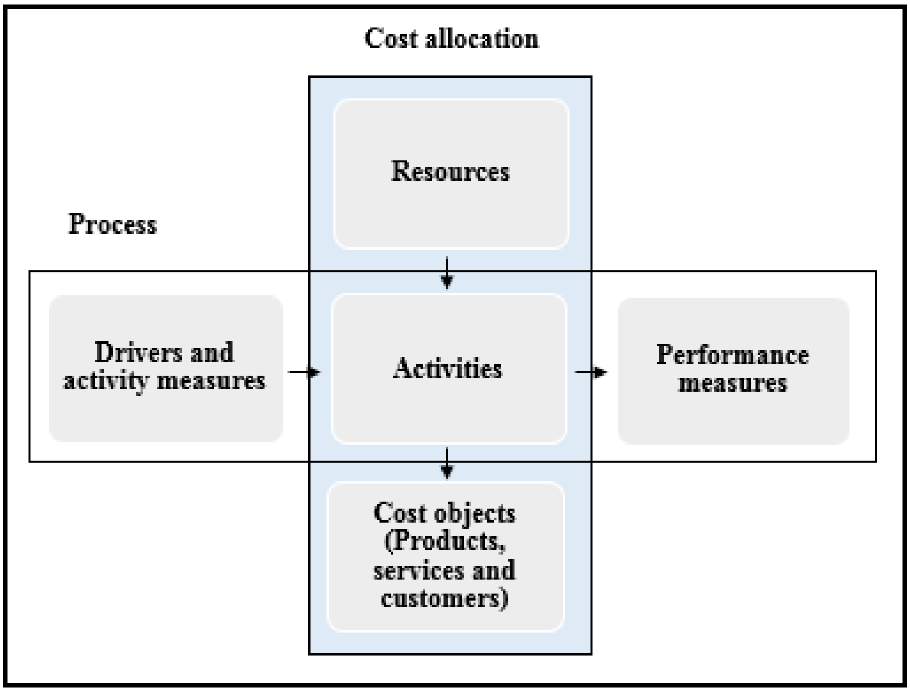

Figure 3. Traditional two dimensional ABC -model (Turney 1994, 83).

The second dimension, monitoring the process, is described in the horizontal axis. It reflects the company's need for new type of information. This means information about events, which have an effect on performance of an activity and information about completed activities, such as what is the factor causing the cost and how well it is performed. **(**Turney 1994, 83**)**

ABC system is used to get more detailed information about different levels of activities and their relationship to products (Tsai 1996, 726). ABC is used not only to allocate costs (fixed, variable and/or overhead) into different activity levels and/or to products, but also to identify the areas of waste (Gunasekaran and Sarhadi 1998, 231). The process of ABC leads to more accurate cost information and produces less distortion (Helberg et al. 1994, 3, 4). For these reasons ABC is excellent tool for the needs of the case company.

2.3.3 Comparison of ABC and traditional systems

The difference between traditional cost accounting and ABC is their difference in allocation methods. In traditional cost accounting systems overheads are often allocated in proportion to direct labor hour. This could in some cases lead to results where a product requiring a lot of assembling time is more expensive relatively to a product that requires less assembling time but involves much more complexity in design, quality and purchasing. This may lead to a situation where the low technology product is overpriced while the high technology product is underpriced. (Helberg et al. 1994, 3; Geiger 1999, 3) Instead of using one or two types of drivers, ABC system uses many different types of second-stage cost drivers that can include also non-volume-based drivers, such as number of purchase orders (Drury 2004, 372), and can therefore create more accurate cost information (Homburg 2004, 332).

Comparing to traditional costing, ABC has two advantages. First, ABC uses cost drivers to allocate indirect costs to cost objects on the basis of the cost driver that actually causes the cost. Second, ABC recognizes the different cost consumptions at different levels. In ABC the costs are allocated according to activities' genuine resource consumption. That way, managers will be provided with accurate information to improve their decisions. (Partridge and Perren 1998, 581; Sheu et al. 2001, 435) In most companies overheads and support costs are allocated by their diminished labor base. Sometimes the marketing and distribution costs are left outside of the allocation. These two allocation decisions leads to distorted product cost information and produces unreliable decision information. (Helberg et al. 1994, 3)

Activity-based costing tries to allocate overhead costs to cost objects more accurately than standard costing. For that reason it is argued that ABC can support medium- and long-term decisions, however it is not clear whether ABC is really a suitable instrument for decision making. (Homburg 2004, 332) According to Datar and Gupta (1994), a company cannot always assume that refining its cost system will always create more accurate product costs. In their study they realized that they cannot formally demonstrate that partial improvements in cost systems necessarily create more accurate product cost. Multiple cost allocation based systems do not automatically capture precisely the diversity and complexity of the activities creating the costs even though more detailed systems usually reduce errors and create more detailed cost information. (Datar and Gupta 1994, 568, 585)

The factors affecting the choice of product costing systems has changed during the years but according to Al-Omiri and Drury's (2007) study, the most influencing factors are: importance of cost information, intensity of the competition, size of the organization, extent of the use of innovative management accounting techniques, extent of use of lean production techniques and business sector. These factors influence especially the adoption of ABC (Al-Omiri and Drurym 2007, 420). According to number of the latest released researches of ABC and standard costing the focus point in the releases is more on ABC (26 ABC –related releases compared to 11 standard costing –related releases in 2014 in Elsevier database). Based on this it is fair to say that the latest research is focused more on ABC than standard costing. However, according to the number of releases on LCC (40 LCC –related releases in 2014 in Elsevier database), product costing is developing more into direction of through-life costing (or life cycle costing) opposite to traditional allocation methods.

3 COST ALLOCATION: THE ACTIVITY-BASED COSTING APPROACH

3.1 Cost allocation process

The cost allocation process, as shown in **figure 4**, illustrates that it consist of three phases: identifying activities, creating cost drivers for allocation and finally assigning the costs to cost objects using cost drivers. (Cooper and Kaplan 1988, 98-99; Horngren et al. 2005, 27-28) In this thesis, however, the ABC is not the one and only method to be used, but a hybrid method needs to be applied. This means that the basic elements of ABC will be utilized with some other basic cost allocation methods. For instance, depreciation and capacity costs are such costs they needs some extra processing before they can be introduced to an ABC process. It is important, however, to know the ABC process more closely.

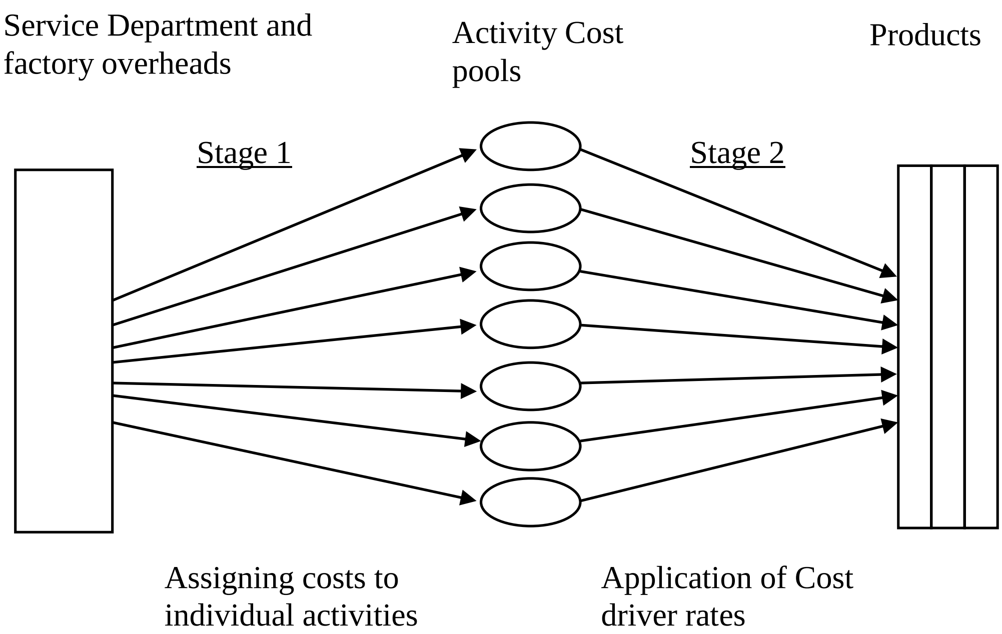

Figure 4. Three phase cost allocation process (Ahmed 2005, 76).

3.2 Selecting costs for allocation

Resources of the company enable the process for manufacturing products. Resources are employees, materials, machines and buildings, for instance. They represent all the assets of the company that create the capacity. Obtaining resources creates costs that follow the whole manufacturing process all the way to the cost objects. (Uusi-Rauva et al. 1994, 34) The end result of cost allocation defines what costs are to be allocated. A decision has to be made of what the allocation includes: fixed costs, variable costs, productions overheads and/or company's overheads. If the company pursues a full cost of a product it can be achieved with a sum of all fixed and variable costs in all business functions of the value chain. (Horngren 2005, 382)

Selecting and forming cost groups is an important task in ABC because the cost allocation base selection begins with identifying whether the costs are direct or indirect. In most cases overhead costs usually are indirect and so for directly untraceable. Identifying these bases defines the number of resource pools into which costs will be grouped in an ABC system. For instance, rather than define each individual cost, such as wages, over time expenses and social security costs, these three could be defined together as a fixed wages resource. That way a homogenous cost pools can be formed where one designed cost driver fits all of the three cost incurred. (Horngren 2005, 149) Resources could be grouped as follows in **table 2** column one.

Table 2. Examples of possible resources and resource grouping, activities and different drivers (Fong 2011, 3; Horngren et al. 2005, 150; Neilimo & Uusi-Rauva 2010, 154).

Cost pools / Resources	**Resource drivers**	**Activities**	**Activity drivers**	**Cost object**
Fixed wages wages overtime expenses social security costs etc.	-Direct labor hours - No. employees	-Inspecting and testing -Ordering and receiving materials -Supervising	-No. tests -No. purchase orders	Product 1 Product 2 etc.
Maintenance	- Direct labor hours	Machining	-Number of machining hours	Product 1 etc.
Administration costs	-Evenly assigned	Administration activity	-Direct manufacturing labor-hours	Product 1 etc.

3.3 Identifying activities

The identification of the activities is one of the first steps in ABC (Cooper and Kaplan 1988). To understand costs, activities, relationships and cost drivers, the levels where costs are incurred has to be identified. There are different levels of organizational activities where costs are incurred:

1. Unit-level costs,
   - Costs of activities related to a group of units or products such as direct material and labor
2. Batch-level costs
   - Costs related to batch produced, such as purchase orders, setup and scrap (if related to the batch)
3. Process-level costs
   - Support costs to individual products to maintain the production or products, such as product development and equipment maintenance

4. Facility or organizational costs
    - Corporate level common costs incurred to stay in business, such as manager's salary
    - Similar costs to corporate level overheads. (Horngren et al. 2005, 143-144; Schniederjans and Garwin 1997, 73; Barfield et al. 1994, 179)

Organizational activities can furthermore be divided into two types for studying overhead costs: structural and executional. Structural cost drivers are used when business strategic choices about organization's underlying economic structure are the focus point. Such as operational scale and scope, complexity of products and use of technology are examples of underlying economic structure. Executional cost drivers are related to the execution of business activities. The activities could be employee utilization, provision of quality service and product manufacturing, for instance. (Hansen et. el. 2009, 380)

The nature and number of the daily activities are defined by the structural and executional activities. If a company produces more than one product or has more than one plant, it creates product-level activities such as need for scheduling. The structural drivers are usually higher level drives: number of plants, product lines processes or degree of work centralization. Executional drivers are activities that are happening in the company, such as degree of employee involvement or plant layout efficiency. (Fong 2011, 2-4)

Operational activities are under organizational activities. Operational activities are activities that happen daily as a result of the process and structure implemented by the company. Operational cost drivers drive the costs of operational activities. The drivers can be divided in different level based on the status of an activity that it drives. (Fong 2011, 3-4) Even though there are different level activities, according to Cokins and Căpuşneanu (2010), activities can, in the end, be defined into two category: main activities and secondary activities (support). According to them, these secondary activities are more than available resources serving the main activities, with them the main activities perform better, and cost drivers should be selected for both types of activities. (Cokins and Cãpuşneanu 2010, 11) Examples of activities are presented in **table 2**, column three.

The activities may be profiled and found by interviewing the people operating in the operations which requires collecting information about the work processes involved within activities. The most reliable source for acquiring information about activities is the operations people. This information can be received by observing the work process or by interviewing and so for listening interviewees' descriptions of activities. (Ahmed 2005, 78, 95)

3.4 Selecting cost drivers

Allocation bases, otherwise known cost drivers, are the trigger points of costs in organization, wherefore an important part of activity-based costing. Cost drivers are defined such a factors which have a cause-effect relationship with costs (Barfield et al. 1994, 178). In other words a unit of an activity that drives the change of the cost either in production or servicing is called a cost driver. It either consumes fewer or greater amount of resources. It indicates to any activity that incurs or causes a cost to be incurred. Normally in traditional costing the cost driver allocates costs relating to quantity of output. (Cooper and Kaplan 1992, 1; Fong 2011, 1; Estermann and Claeys-Kulik 2013, 8)

The drivers can usually be divided in two main types of supporting cost: resource driver and activity driver as are done in major of studies (Ben-Arieh and Qian 2003; Cokins and Cãpuşneanu 2010) or primary and secondary drivers (Gunasakeran and Singh 1999). According to Fong (2011, 1), resource driver can be defined as a contribution of the quantity of resources used to cost an activity. For example one kilogram of sugar or flour for a coffee bread production and one machine hour for manufacturing work can be examples of a resource driver. The second driver is an activity driver. An activity driver is an event or activity that creates the cost by the activities required to complete a specific task. Activity drivers affect directly production costs through the activity measured without a direct relationship with the production volume. Examples of activity drivers with overhead costs could be inspection costs and number of inspections or production runs. (Ben-Arieh and Qian 2002, 173; Fong 2011, 1) **figure 5** illustrates that resource drivers are positioned between resources and activities, while activity drivers allocate costs from activities to cost objects, such as products.

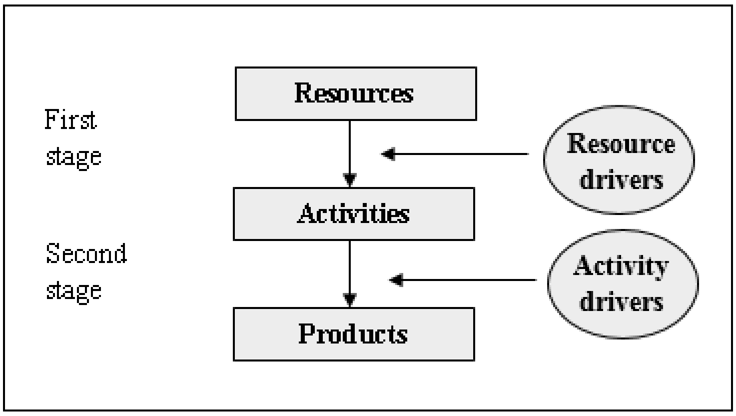

Figure 5. The ABC -model (Tsai 1996, 725).

In addition to this traditional division Barfield et al. (1994, 178-179) presents a different type of method on categorizing cost drivers: volume-based drivers (such as machine hours) and non-volume-based drivers (such as square feet of operation space). Based on different researchers (such as Cooper and Kaplan 1988**,** Barfield et al. 1994 and Ahmed 2005**),** the main idea of activity-based cost drivers rests on the premise that the inadequate volume-based drivers should be replaced with non-volume-based drivers. Resource and activity drivers are used when there is knowledge of the process, costs and output and there is a relationship between drivers, costs and output. But there are differences about the relationships that have to be understood before selecting the drivers. For example, normally cost drivers for long-term overhead costs cannot be related to volume of activity or output, but short-term overhead cost driver can be. (Kinney and Raiborn 2009, 109)

Cost driver selection process

The cost driver selection is a multiphase process. To understand the decisions behind the selection of cost drivers, one must first understand the selection process of the drivers. According to Schniederjans and Garwin (1997, 73), when selecting cost drivers, a number of considerations must be taken into account simultaneously. For example, the selection criteria factors can be quantitative or qualitative or a combination of the two. However, the use of too many drivers can limit the usefulness of the ABC system (Barfield et al. 1994, 215). The complexities with the number of possible driver alternatives, can create a difficult situation for the decision maker. That is why an organization has to undertake a cost driver selection process. The cost driver selection process includes an analysis of costs and their causes in order to identify possible cost drivers, measure the driver-to-cost relationship, and illuminate the relationship. (Schniederjans and Garwin 1997, 73)

The candidate drivers must be identified for each cost appearing at a level (introduced in chapter 3.3). At least one driver, preferably multiple cost drivers, is chosen for each cost at the particular level. (Barfield et al. 1994, 179) It is good to have multiple candidates of cost drivers, however Turney (1991, 282) suggest that 10 to 30 drivers are most likely to be sufficient for most cost assignments.

The allocation process of ABC system usually utilizes a two stage process. Identifying the organizational activities (introduced in chapter 3.3) is the first stage. The overhead costs are assigned to activity cost pools using the first-stage cost drivers. The second stage is the allocation of the costs in the cost pool to cost objects using the second-stage cost drivers. (Schniederjans and Garwin 1997, 73) According to Turney (1991, 281-283), the methodology of current cost driver selection is strictly rule-based, so he has come up with the following list of the selection process:

1. Select activity drivers that match the type of activity.

2. Select activity drivers that correlate well with the actual consumption of the activity.
3. Diminish the number of unique drivers.
4. Select activity drivers that encourage improved performance.
5. Select activity drivers having a modest cost of measurement.
6. Avoid the usage of activity drivers that require new measurements.

Each step of selection process is important. For instance, the study made by Geiger (1999) one of the most critical step is number four on the list above. The study shows with an example the importance of the drivers influence for the performance of the company and what extreme consequences there can be when selecting a wrong driver. In Homburg's (2001) study can be seen that the selection of cost drivers can be achieved successfully if the set rules are followed.

Challenges in the selection of cost drivers

Selecting the appropriate cost driver or multiple cost drivers from the set of possible candidate drivers is a hard task to perform. The drivers are often selected by application of human judgment which in turn is based on analysis of simple accounting systems or correlational techniques from statics. The ideal result of selecting of cost drivers is rare because real world resource limitations are often left out of the selection process. (Schniederjans and Garwin 1997, 74) The selection of cost drivers incurs, in the end, always by studying the context of an organization.

Cost driver selection is one of the major issues in implementing ABC because the accuracy must be traded off against the complexity of the ABC-system (Homburg 2001, 197). The accuracy in cost allocation is important because it reduces the errors made in decision making processes (Datar and Gupta 1994, 568). According to Homburg (2001, 197), there is a contradiction between the number of cost drivers and accuracy in allocation: to achieve high accuracy it often requires a high number of cost drivers, whereas to make ABC-system easier to understand and to achieve acceptable cost information a small number of cost drivers is desired.

Since overhead fixed costs are usually indirect costs, finding the right cost drivers becomes essential. One of the most challenging tasks in allocation is indirect costs assignment and the selection of suitable accounting techniques and methods (Toompuu and Põlajeva 2014, 1015). Because there rarely is a causal relationship with the indirect cost and cost object, it is hard to allocate the costs properly (Toompuu and Põlajeva 2014, 1015; Geiger 1999, 6-13). For instance, consider allocating the setup costs by using number of batches as a cost driver. Now there are two cost targets which costs managers can try to reduce. By reducing the number of batches the cost of setup will reduce at the same time. Using some other driver to allocate setup cost can make it appear to be "free good" that is over consumed while trying to please customers. (Geiger 1999, 2)

However, selecting cost drivers primarily for their behavior impact is dangerous. If the driver is based on reducing cycle time or number of parts, for instance, there is a possibility of going too far while trying to add overhead. Or allocating hazardous waste material based on the kilograms disposed may lead to illegally dumping such materials as normal waste, only to reduce the costs. The behavioral impact needs to be considered when deciding cost drivers. (Geiger 1999, 2-3)

The availability of reliable data is another factor to be considerate while choosing cost allocation bases. The cost allocation base has to be such that there is appropriate and accurate data available for allocating the costs. If the data is unreliable or difficult to obtain it could be that some other measure of complexity needs to be used. However, there is a potential problem that the new data may not fully represent the complexity of the base. (Horngren 2005, 149; Geiger 1999, 2, 5)

3.5 Assigning costs to cost objects

Once the costs to be allocated are selected and cost drivers and activities are attached, the next step is to allocate the costs from activities to cost objects causing or consuming the costs. This indirect assignment of cost, according to some researches (Kulmala et al. 2002; Turney 1991), is something to be avoided if possible, but need to be done if necessary. However, with ABC this allocation process is the essential phase when defining product costs. When the cost allocation is made the cost information can be used in many different ways. According to Malmi (1997, 47-49), results received from ABC were mainly used to products' profitability examinations, including e.g. inventory valuation. The second most common reason to use ABC was pricing decisions and the third was activity's efficiency, speed and quality inspection. The allocated costs could be integrated to other programs to achieve more detailed cost information, if the need arises for such purposes (Lumijärvi et al. 1995, 108).

There are some studies about implementing ABC at food industry like the study of Granlund's (2001). When Granlund's study illustrated the factors leading to failure in ABC project Faraji's et al. (2015) study shows what effects succeeding with ABC project can have. The study illustrates that successfully adopting ABC there are significant differences between the cost information provided by ABC method and traditional systems; ABC provides mainly better quality information and also better financial information. This further leads to better allocation of overhead costs, better planning and control of products affecting positively on company's profits (Faraji et al. 2015, 1).

3.6 Handling capacity

Calculating available, used and unused capacity is a difficult task to do. According to Cooper and Kaplan (1992, 1), a following equation formalizes the relationship between costs used and resources available:

$$Unused\ Capacity = Activity\ Availability - \ Activity\ Usage \quad (1)$$

This type of a calculation is used in ABC when determining the cost of an activity. However, ABC does not solve all of the problems in product costing and capacity handling is one of them. ABC gives some tools to be applied in handling unused capacity (for instance time-driven ABC) but it would require collecting more detailed information and keeping track of time usage. (Everaert et al. 2008, 122-123, 133) There are, nevertheless, some tools to handle capacity in product costing. Unused capacity can be treated in different ways. Unused capacity can be adjusted to different productions in processes**,** it can be seen and be treated as the cost of doing business, it can be controlled by adjusting some lower level of services by efficiency lost with reducing the number of times activities are performed or increasing the efficiency of activities performed. (Ahmed 2005, 114; Cooper and Kaplan 1992, 10)

Resource planning, or rough-cut capacity planning is the key element in capacity handling and it is meant as a long term capacity planning tool for management (Greene 1997, 10.6, 10.7). According to McNair & Vangermeersch (1998, 50), rough-cut capacity planning was developed because traditional Material Requirements Planning –models did not take capacity into consideration well enough, leading to tendency to develop an overstated MPS which is unattainable under existing operating conditions. The rough-cut capacity planning's aim is to uphold the information of different products' or orders' need of capacity and assures that the production plan is achievable. Based on the need can be made some estimates how the production loads the capacity. (Greene 1997, 10.7)

Capacity decisions and changing environment

Changes in market situation can create alterations in company's capacity planning. The changes in demand create either loss in capacity or overcapacity if the company is unable to date capacity changes beforehand. The timing of capacity changes is crucial for the company: poor reaction time or wrong decisions in forecasting the demand can lead into long delivery and in the end lead to losses of market share. The timing in capacity changes is difficult to forecast because of the lead-time required to decision making: hiring employees, training them or acquiring machines, for instance. (Olhager et al. 2001, 217; Raturi & Evans 2005, 153) Companies can prepare for capacity changes with different strategies introduced in **figure 6.**

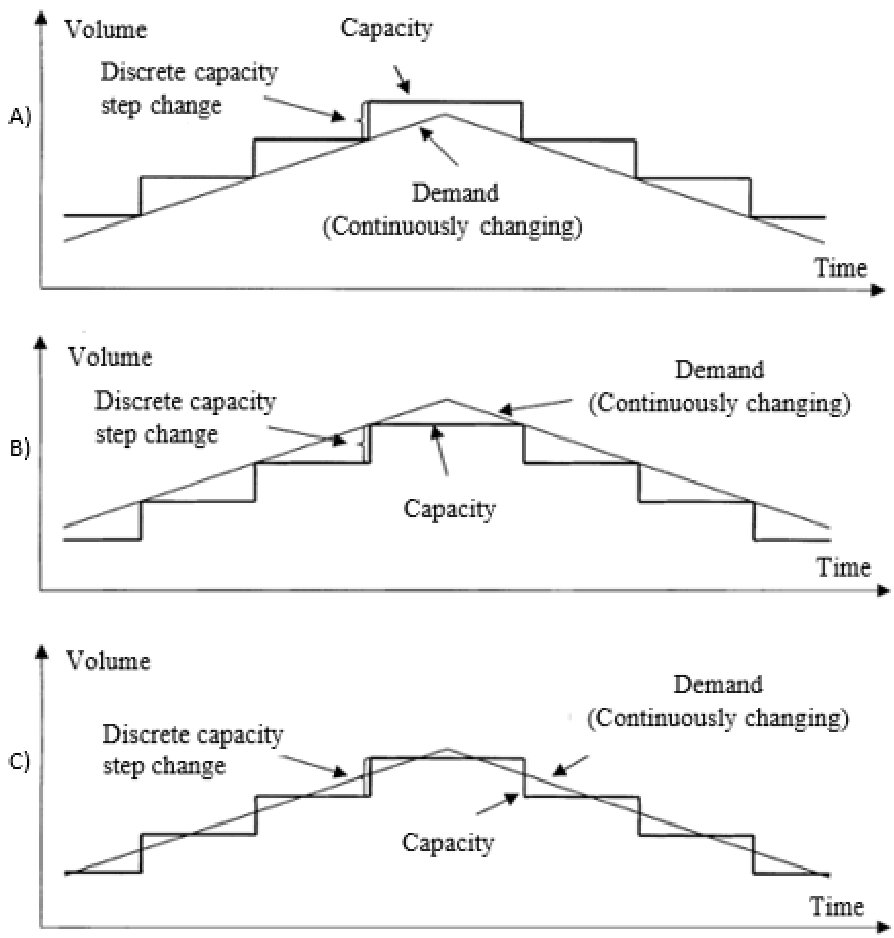

Figure 6. Three variables to describe capacity strategy: a) Excess Capacity Policy, b) Capacity Shortage Policy, c) Capacity Tracking Demand (Olhager et al. 2001, 217-219).

The changes in capacity happen usually in two different ways: by changing existing products, processes or markets; or by emerging new products, processes or markets. Capacity lead strategy **(figure 6a)** is employed when company invests in capacity in advance of demand. That way it can eliminate the chance of losing sales to competitors by assuring the promised lead delivery times. However, this type of strategy is a higher cost profile but it is easier to maintain the delivery reliability and flexibility. If the company does not believe that the losses in market share outweigh the costs of keeping the excess capacity, it can use lagging demand strategy **(figure 6b).** (Olhager et al. 2001, 217; Raturi & Evans 2005, 131, 154)

Figure 6b illustrates the strategy when company believes and trusts that the risks for expanding capacity utilization rate are greater than the risks of losing market share (Raturi & Evans 2005, 155). This strategy is used usually when company competes with price, and there for the basic principle is to produce as much as possible while maintaining full capacity utilization. The lagging strategy is, however, difficult and risky to maintain when the demand is declining because the decrease of capacity needs to take place when the utilization is still high. This strategy is used in situations where there is high-volume and standard items are typically produced continuously. These items are usually produced to stock and predominant winner is usually price. (Olhager et al. 2001, 218, 222 – 223) This strategy is not appropriate in this case, because of the limited shelf life of the products in food industry business. According to Johansen and Riis's study (1995, 461 – 462) bicycle manufacturer Grad Ltd uses this type of strategy successfully.

The last strategy (**figure 6c)** illustrates the trade-off of the two strategies above. Tracking strategy tries to track the demand as close as possible. The expansions in capacity are made only when managers expect that they can sell some of the additional output, but without really knowing it for sure. With this strategy the company has, depending on demand, either excess or lack of capacity. (Raturi & Evans 2005, 154) Based on theory, the best capacity strategy for the case company is either excess capacity policy or capacity tracking policy.

4 BACKGROUND FOR VAASAN GROUP

4.1 Introduction: VAASAN Group

"VAASAN is passionate about being the first choice in everyday enjoyment and health"

-Vision, VAASAN Group

VAASAN Group was founded in 1849, its first bakery was set up in 1904 and the company has since developed enormously. Today VAASAN Group employs more than 2,500 people in 17 production facilities and operates in seven different countries. VAASAN Group exports to almost 40 countries all around the world. At the moment the current owner is Lion Capital but the company will be sold to a Swedish company, Lantmännen. (VAASAN OY, 2014; VAASAN OY 2015)

VAASAN Group is an international pioneer in baking and one of the most eminent operator in Northern Europe's bakery industry. VAASAN Group is the leading company in Finland's markets and Baltic region. The company is also the largest thin crisp and the second-largest cripsbread producer in the world. In bake-off area VAASAN Group is also one of the leading companies in the Nordic countries. In addition to production units VAASAN Group also has founded some factory shops to sell their freshly baked products straight to the consumer. (VAASAN Oy, 2014) **Figure 7** shows the company's net sales by business area.

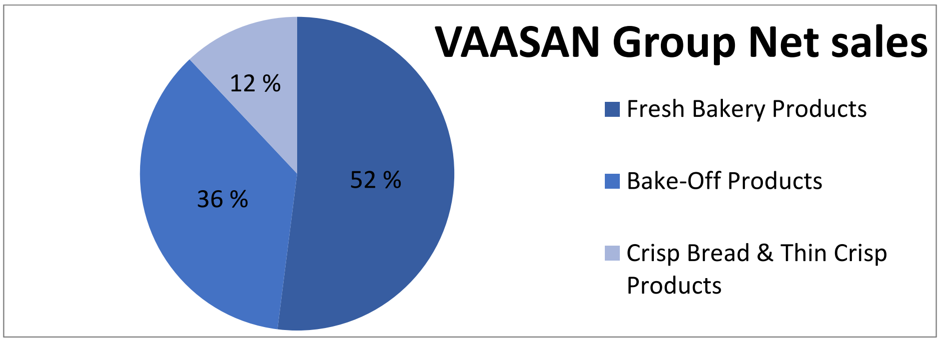

Figure 7. VAASAN Group net sales by business area in 2013 (VAASAN Oy, 2015).

This thesis is based on the business area of fresh bakery. Fresh bakery –business area employees around 40 % of the employees in the concern and it brings approximately 50 % of the company's income (**figure 7**). Because the business area is so large in income and employment and its processes are really similar almost in all of the production units, fresh bakery was selected to be studied. Production –unit A was selected because it is close to the writer and it has all elements that appear in other units as well. (VAASAN Oy, 2015)

4.2 Production unit A

As said earlier VAASAN Group operates in three different business areas: Fresh Bakery Products, Bake-Off Products and Crips Bread & Thin Crisp Products. This thesis bases on VAASAN Oy's fresh bakery unit A. The production unit A produces some of Finland's most known fresh bread products. In addition to breads The unit produces also different kinds of bread rolls.

Production unit A has approximately 120 employees depending on the production and demand (Koponen 2015). Production unit A produces over 100 different products which creates challenges in product costing. Because of the wide range of products it is important to understand which products or processes create certain costs. In Production unit A there are several individual production lines and one additional line for "coffee bread -baking" (CBB). The costs for three individual lines are clearer to calculate but to consider this additional production line creates challenges: it consumes a lot of operating space but produces significantly less in kilograms than other production lines. However, the line is essential for the operation and so for the cost allocation need to be done fairly.

4.3 Current cost allocation system

The company divides into several different main cost centers from where costs are allocated. Cost centers are based on administration and business planning, R&D,

sales-delivery process, manufacturing and procurement processes, for instance. Also some individual processes are monitored separately. These costs from cost centers are then allocated to different business areas and further on to the production units.

The current cost allocation is based on a modified version of standard costing and standard and at the moment only the production unit's variable costs are calculated and allocated to the products. Because the business is changing, competition has increased and the base for allocation criteria has changed to follow the principles of IFRS the need for more detailed cost information has become more important. This has created a need for more specific product costing. The need to gain more specific product information is one of the reasons to improve product costing because it is required in the standards of IFRS. Because it is important to stay in the competition, the product development by itself is not sufficient enough, also the costs need to be surveyed. These have created the base for the new product cost allocation system. The purpose of this new system is to improve product costing and add cost awareness by allocating production unit's overhead costs to products.

5 DEVELOPING THE NEW ALLOCATION SYSTEM

5.1 Starting points for the new system

As said earlier, there are a lot of different kinds of methods to cost accounting: standard costing, job-order costing and activity-based costing, for instance. All of the methods have potential to be the right one for VAASAN Oy, but ABC was selected to be applied because it is a method VAASAN Oy has been seen to be fit to use in future (Nissi 2009, 90), the selected method is also previously known to the users and so for easier to adopt, it allocates costs using both value-based and non-value-based drivers and most importantly it was seen to fit the purpose of this thesis: it allocates costs fairly and according to requirements. Like said in theory (chapter 2.1) there are several different costs. In this case the costs are unit's fixed overhead costs, which consist of fixed wages and rents, for instance. The new cost allocation system bases on the interviews and collected cost data.

The primary expectation of the new allocation system stated by interviewees is to create and improve the transparency of overhead allocations. Transparency would be received by more detailed system and each or at least some of the functions should be shown in separate rows on cost statement to get more detailed information about the allocated amounts. There is also need for combining variable and fixed costs together for fuller cost information. For that reason there is need to produce this fixed cost allocation in the same form as variable costs are already assigned (Lauri 2014; Suna 2014). Units' managers and controllers would also hope that the new system would provide them with information about the cost of different production lines' unused capacity. Also the need for improved cost information was emphasized: there is need to know which sections of the unit are the most ineffective, where there is idle capacity to be used and the numbers must be right in order to make right business decisions. (Korppi 2015; Vainonen 2015; Koponen 2015; Suutarinen 2015) This requires careful reasoning about fundamental cost drivers and activities of the new allocation system for units' overhead costs.

In summary the set targets for this new allocation model:

1. Transparency to costs
2. Detailed cost information
3. More detailed costing information about products
4. Find the idle or unused capacity and recognize the behavior patterns

Improved cost awareness is also one of the desires for the new cost allocation system. Ideally the cost allocation system would provide precise information about products' costs and would help in pricing decisions. It would help managers to understand the usage of overhead costs and see how certain services create costs.

The fifth target for the model:

5. Improved cost awareness

Predictability is also something that is wanted because good decisions cannot be made based on poor cost information. The suggestions of interviewees were taken into consideration when defining the activities and cost drivers. That way the cost allocation bases and relations are more realistic and more thorough cost information can be achieved. The product cost allocation –project is seen as a one-time occurred assignment, after which the company decides on further development. The product cost model has seen best to make with Excel-placed model. This way there is no need to make any expensive software investments which has been seen as one of the most important hopes. Because the new model was meant more for strategic than operative decisions, the focus is on the vertical axis (**figure 3**) and on allocation dimension.

The model will be based on production units last year's actually incurred cost data. When using the actual occurred cost information the valuations of product costs are exact. If the allocation were to base on budgeted figures the allocation would not give exact results. In this case, while testing the functionality of the model with the incurred cost information from last year, last year's allocation form corporation has not been made according to the criteria, and therefore this year's budgeted allocations are to be applied.

5.2 Structure of the model

The next step after completing the interviews, acquiring theoretical information on cost allocation systems, especially ABC, and analyzing the needs for the system, was to start developing the new system in Excel. Based on the interviews and feedback received from the company the first version of structure was defined.

The structure of the model became as very important part of the process because it had to be easily modified if necessarily. With that in mind the basic guide lines for the model can be set up. First discussion with the controllers of the company brought up three-level allocation for the units. The allocation phases, based on discussions, are shown in **figure 8**. Firstly the costs needs to be allocated to activities, then to production lines and finally to individual products. However, based on discussions later on and after some testing, a decision was made to modify the model and to keep one of the allocation phases as an alternative option: the costs can be allocated form activities straight to products leaving the 'production line' -phase away (as is presented in **figure 4**) or it can be allocated as presented in **figure 8** depending on the activity. The allocation with three phase model will create more detailed cost information but it was detected to unnecessary with some costs. The gained results with some costs did not exceed the costs of the work. For those reasons it was decided that the new allocation system mainly follows the principles of the traditional ABC with some alterations.

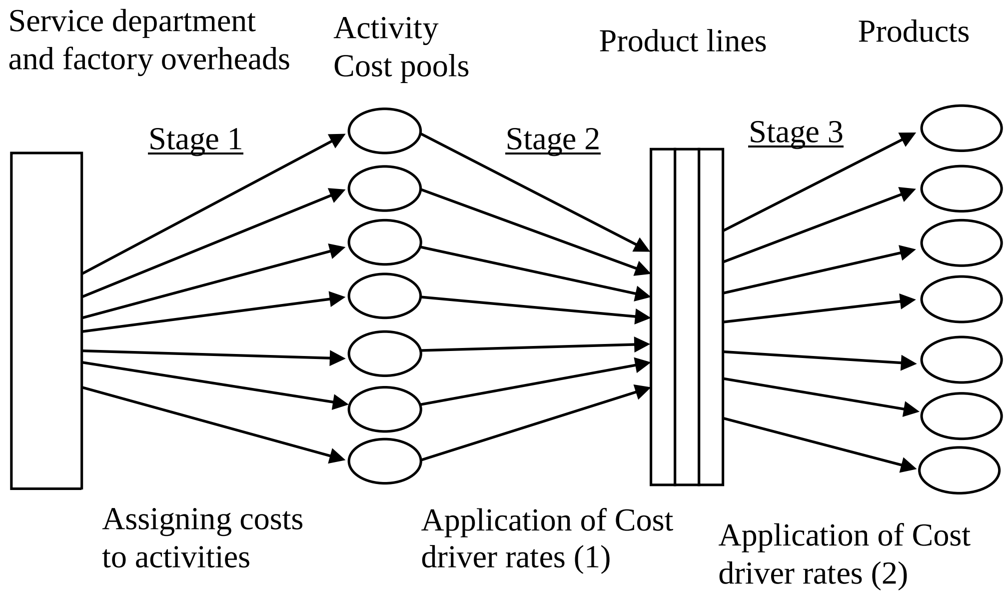

Figure 8. Four phase allocation model is more detailed but at the same time more complex.

After deciding on the main structure of the model, the second phase was to select and define resources (or cost pools) according to the theory 3.2. There are two different options how the cost pools could have been formed at VAASAN Oy. Firstly, one way to define the pools was to handle each production line and its' products separately by dividing the costs between production lines. The difficulty in this method is to define the usage of costs for each line appropriately. However, because the production line –stage was seen too complicated the second option was selected: the cost pools are formed to suit all products in general and the allocation can be made fairly. The selection of cost pools is made based on the needs for Production unit A to simplify the development of the model. The costs to be allocated need to be separated from all of the cost data and grouped for simplifying the allocation process. In this phase there were selected 11 resource pools:

- Production unit's fixed wages (Includes all of the administration wages, social security expenses and other personnel expenses such as health care costs)
- Building rent & tax
- Cleaning

- Maintenance – Machines (This resource group includes only machines based costs. Maintenance of machines ensures the continuity of production of the products in terms to device failures)
- Maintenance – Buildings and others (Includes building related cost)
- Other fixed costs (Travelling and office costs, for instance)
- General Building expenses (This group includes real estate management and pest control, for instance)
- ICT (All of the costs connecting to IT, for instance, ICT software expenses)
- Waste management
- Depreciation (of machines)
- Quality control

The grouping list above was based on the cost data and discussions about importance of different costs. The idea of grouping was to focus on the factors that create the major of the costs and assign them correctly to products, which according to theory (chapter 3.2) is best way to ensure fair allocation of the costs. That is why similar costs were added together to be allocated further on. In addition to cost pools above three additional resource groups were yet to be found to improve the allocation:

- Allocated fixed costs from Group
- KP AA (Group type of costs)
- KP BB (Group type of costs)

These additional resources were created for some higher level costs that are allocated to production units to keep the model intact if there were to be any changes on higher level of organization. After grouping the resources the focus can be transformed to finding activities and resource drivers to allocate these resource costs to activities.

5.3 Defining activities

The definition of activities was an iterative process. Some of the activities and their suitability were in times questioned. Some of the activities were rethought and pooled together so that they would serve the model in the best way possible. There were also some additional activities listed to the actual model, because the model needs to work in other production units as well. These activities, however, are not introduced in detail. It is important to understand that there are several different activities to be used but in this case the best activities suited were selected.

The definition of activities is based on the type of resource. There were found 14 different resource groups and the activities need to be defined and selected for each resource. Next each individual resource is introduced and the activities selected are explained. The first five resources are the biggest groups by the amounts of costs.

Production unit's fixed wages & social costs

In this case production unit's fixed wages were defined such a resource pool, that it includes not only the production unit's managers' and administration's' wages and social security costs but also work clothes and expenses of employment, for instance. Based on the given requirements also the supply chain director's costs were added to these wages at first but after founding the supply chain management–resource those costs were transferred to it (Lauri 2014; Suna 2014).

For defining activities there had to be made some interviews with three different units' controllers, production managers, units' supervisors and "production planners" as was recommended to do in theory chapter 3.3. According to production manager Paasolainen (2014), the activities for fixed wages & social costs can be found based on the work and duties of managers'. By going through the supervisors job description and interviewing some of the units' supervisors there were found several different activities.

The activities were narrowed down into five core activities: resource planning, production planning, administration activities, quality control and supervision of work. The differences between units were not with the activities but with the time spent and importance between activities. However, to simplify the model a questionnaire was implemented and the results gathered from it applied as the ratios to allocate the costs. If there were to occur significant changes in the production the questionnaire could be implemented again.

Building rent & tax

Building rent is the biggest cost of all costs and one of the most essential cost for function. Without paying rent there would not be a place to create products and operate business. There were found only two possible activities to use when allocating building rent & tax costs: building rent and unused floor-capacity. In some units the floor space is used unwisely creating areas that are not used properly. In those units it is important to see the cost of that unused space and see if it could be used in more efficient way.

Cleaning

For cleaning costs there was not detected any other possible activities than cleaning itself. By using activity called cleaning it is clear to see what it includes and what causes the costs. It can also be allocated to production lines based on their usage of the cleaning activities.

Maintenance – Machines and Maintenance - Buildings and others

By going through cost information the maintenance costs were easy to detect. Firstly there was an idea to group the maintenance costs of machines, buildings and others and use these terms as the activities, but later on based on discussions it was seen best to keep the resources separate. By keeping the resources separate the amounts of costs were simpler to handle and by not adding the grouping the calculations simplified significantly. The activities were kept as simple as the resources are: maintenance – machines and maintenance - buildings and others.

Other fixed costs

Other fixed costs consist of unit's supporting activities like meetings and office costs. These costs are all administration based costs that relate to all products. That is why the activity called 'administration activities' was selected. Even though some activities, warehouse management and production planning for instance, consume these resources more than others, the difference is not significant. But if later on in the future these differences need to be taken into consideration the possibility is always open.

General building expenses

General building expenses are what they say they are: general costs of the building. These costs are occurred by the activities of maintaining the building. These cost affect the production unit as whole and it cannot be divided into different meaning activities. That is why the activity 'general building maintenance' was created. It is an accurate and telling activity that can be allocated accurately further on.

ICT costs

ICT costs were also easy to detect form accounting data, even though there were some difficulties concerning the ICT costs allocated from the group. Because the allocation for ICT costs is similar and not dependable on under which resource group the costs are, a decision was made to add the concerns allocated ICT costs to this resource group.

Activities to be found for ICT costs were quite rare. There were only few options that came up with discussions but the main activity was founded in the packing processes and administration processes. For that reason 'ICT related administration activities' was selected as the main activity. If later on some other activities will come up to notice, then they can be added to the calculations. But at the moment 'ICT related administration activities' was seen to be the most important activity creating the units ICT costs.

Depreciation

Depreciation costs come from outside of the production unit's cost center. These costs are gathered from the unit's separate cost data and therefore they need some additional processing before introduced to the ABC process. Depreciation is mainly caused by the depreciation of machines. That is why the best and most describing activity is 'depreciation of machines'. However, a second activity was considered to be used alongside the 'depreciation of machines': unused machine-capacity. The unused machine-capacity illustrates the amount of depreciation that is not used properly. As an example the depreciation of machines is paid for 24 hours of the day and the machine is used 1only 6 hours a day. That creates the fact that 8 hours of the day, when the machine is not being used, is 8 hours of paid depreciation costs for unused machine utilization. However, the test results did not give wanted or even realistic results because of the capacity calculations inaccuracy and therefore this activity was rejected. In the future this could be utilized if the capacity calculations in the production units were to be alike.

Waste management and Quality control

These two resources can be assigned to activities as they are: waste management and quality control. They cannot be grouped with other activities because of their individual principle of allocation to the products. This action guarantees that the resources are allocated correctly with suitable drivers.

Allocated fixed costs from Group

Originally the costs that create this resource pool were designed to be part of fixed wages & social costs and ICT costs. However, some of these costs behave differently than the ones above so this additional resource group was founded. The costs included are mainly the wages of supply chain director and managers'. All of these costs are quite general and they have been assigned to different production units according to their production volume. The activities best suited for these costs are: supply chain management, procurement, technics and ICT. These are the activities that root the costs of supply chain management.

KP AA and KP BB

The costs creating these resource groups are wages allocated from the group and supply chain. The activities for these resources were found based on the personnel's' work definitions: administration activities, production planning, maintenance - machines and logistics.

The main activities used in the model are presented in **table 3** where there is defined the levels of activities identified in the unit following the criteria of chapter 3.3. The activities are mainly 'support activities' that are performed at four different (organization, process, batch and unit=product) levels.

Table 3. Activities and levels of activities presented.

Activities	Level of Activities
1. Administrational activities	Organizational level
2. Building rent & tax	Organizational level
3. Cleaning	Process level
4. Depreciation of machines	Process level
5. General building maintenance	Organizational level
6. Maintenance – Buildings and others	Organizational level
7. Maintenance – Machines	Process level
8. ICT related administration activities	Organizational level
9. Logistics	Organizational level
10. Procurement	Batch level
11. Production planning	Batch level
12. Quality control	Batch level / Unit level
13. Resource planning	Batch level / Unit level
14. Supervision of work	Process level / Unit level
15. Supply Chain Management	Organizational level
16. Technics	Organizational level
17. Unused floor-capacity	Organizational level
18. Waste management	Organizational level/batch level

The costs are divided into 18 different activity groups with the new method. Before the costs were on their individual accounts and the general grouping was not as specific. With this new definition of activities the costs are easier to realize and inspect.

5.4 Selecting the drivers

5.4.1 Resource drivers

After the activities were defined the cost drivers were selected. The driver selection was affected by the fact that VAASAN Oy is an organization which has high overhead and mix of products. As said by Cooper and Kaplan (1988, 97) using only one cost driver in this kind of situation the cost evaluation may be distorted. That is why multiple different drivers were selected for resources and activities. The cost driver selection followed the principles of chapter 3.4.

To keep the model simple only four different drivers were selected for resources: evenly assigned, square feet (m2), no. personnel and percentage (%). Why so few drivers? Many of the resources have only one or two different activities where the resources are assigned so there is no need for more complexity in resource drivers. These resource drivers, at the moment, are sufficient for the purpose, and as is explained in chapter 3.4 too many drivers may cause disorientation. **Table 4** shows the relative shares of all resources allocated with defined drivers to each activity as an example with modified numbers from the original data.

Table 4. Share of costs allocated to different activities with modified numbers.

Cost pool / Resource	Resource driver	Share of total costs	Activity	Share of total costs
Maintenance - Machines	Own cost	25,0 %	Maintenance - Buildings and others	31,0 %
Maintenance - Buildings and others	Own cost	21,0 %	Building Rent & Tax	22,0 %
Building Rent & Tax	Square feet (m2)	21,0 %	Maintenance - Machines	11,0 %
Production unit's Fixed wages & social costs	Percentage, %	15,0 %	ICT related administrational activities	8,0 %
Waste management	Own cost	3,0 %	Administration activities	5,0 %
Other fixed	Evenly assigned	3,0 %	Cleaning	3,0 %
ICT	Evenly assigned	3,0 %	Depreciation of machines	3,0 %
General Building expenses	Own cost	3,0 %	General Building maintenance	3,0 %
Allocated fixed costs from Group	Own cost	1,0 %	Production planning	2,0 %
Cleaning	Own cost	1,0 %	Quality control	2,0 %
Depreciation	Own cost	1,0 %	Resource planning (personnel)	2,0 %
Quality control	Own cost	1,0 %	Supervision of work	2,0 %
KP AA	No. Personnel	1,0 %	Supply Chain Management	2,0 %
KP BB	No. Personnel	1,0 %	Logistics	1,0 %
Total costs to be assigned		**100,0 %**	Procurement	1,0 %
			Technics	1,0 %
			Unused floor-capacity	0,5 %
			Waste management	0,5 %
			Total	**100,0 %**

Table 4 above shows, for instance, that together the four biggest pools, Maintenance - Machines, Maintenance – Building and others, Production unit’s Fixed wages & social costs and Building rent & tax create 82 % out of the total amount of costs. They are allocated to activities so that the maintenance and building expenses takes over 60 % of all costs. The amount is relatively large and therefore those costs need to be allocated accurately to products, which in turn require activity drivers to be specific and accurate.

Majority of resources can be allocated to their activities either evenly assigned or according to their own cost because they have only one activity. For instance maintenance costs can be allocated straight from resource pools to their activities. Building rent & tax, Allocated fixed costs from group, KP AA, KP BB and production unit's fixed wages & social costs are the six resource groups that need different types of drivers than others.

Building rent & tax has only two activities to which the costs are allocated. The cost of Building rent & tax is allocated to its activities with a non-volume-based driver 'square feet (m2)'. This type of driver was selected because the rent is basically paid by the square feet of the building and not dependable on the volume produced in the unit. In some units the floor area is poorly used and there for some amount of the rent is paid for unused floor space. With units' floor plans the square feet for both used and unused area was calculated. The cost is then divided with the relation of floor usage. This same driver can be used when allocating the costs of activities to production lines.

Percentage was seen as the best driver to allocate production unit's fixed wages & social costs since the pool consists of wages of different activities. The activities are performed by a group of people and their estimated percentage for time usage to each activity was used as the driver. Other possible drivers were considered but they were rejected. For instance, using 'direct labor hours' would have been accurate but it would have also created a need for work hour monitoring, and that was seen unnecessarily compared to the obtained benefits. That is why the estimated amount of time and percentage was used, which was obtained by questionnaire directed to work supervisors. Number of personnel was one of the considered drivers, but it was seen to fit KP AA and KP BB resource groups better because they had more specified work activities.

5.4.2 Activity drivers

The selection of activity drivers is a bit more complex because most of the activities require individual drivers that are suitable just for them and their needs. This can be reassured by following Turney's rules (see chapter 3.4) and matching principle. The drivers were thought at the same time as activities were defined. However, when testing the model some of the designated drivers appeared to be unfair to some of the products even though they were to seen as the best option to use. This created some unexpected changes and rethinking for the driver selection.

When selecting the activity drivers the allocation path needed to be kept in mind. For instance, from **appendix 3** there can be seen that some activities are allocated straight to the products without the influence of production line. This straight allocation, leaving production line –phase away from calculations, ensures that the line where the product is produced does not have an effect for the allocation. If, for instance, the driver is number of kilograms produced, the costs are divided with the same amount of euros to kilogram. If the line was to be in between with an additional driver, the costs of the products would be different between the lines and in some cases it would alter the results unnecessarily.

The allocation path was also considered when deciding the spare drivers for other units as well. The possibilities to change the drivers depending on the production unit was also one of the priorities when creating drivers and formulas to be used in excel spread-sheet. Especially this phase created some hardship for the design of the model. The formulas in the model needed to consider the possibilities of using the production line and skipping the line altogether.

The activity drivers selected to suit all of the activities are presented with the activities they were designed to:

1 Administrational activities - Organizational level

Because administrational activities is an organizational level type of activity, the costs are caused by activities that benefit all products equally; meetings, legal fees and training, for instance. This activity is not dependable on the production line so that phase can be left out of the allocation process and the costs can be allocated straight to the products without production line -phase.

To assure that the costs are directed with accuracy to the products the driver to allocate these costs was selected to be kilograms produced. Even though not all of the products weight the same amount, the costs are normally studied by €/kg. The other two options were to use produced myks (= number of produced units of the product) or evenly assigned -drivers. The driver evenly assigned was rejected because it does not take the production volume into consideration and so for it is not evenhanded. Produced myks would have been equally good driver but it was rejected because produced kilograms suited the situation better.

2 Building rent - Organizational level

Building rent is an organizational activity that, like administrational activity, benefits all of the produced products. The rent of the building is caused ultimately by the amount of square footage the building. That is why, the costs are firstly allocated to production lines with the amount of square feet required. The targeted floor area is divided between production lines in accordance with the number of square foot required. This way the rent can be determined for each production lines caused by the consumed square footage. The untargeted area is further on divided to production lines according to the produced kilograms.

The costs are allocated from production lines to products according to their individual production run + changeover time. The time the product uses the production line is the time it consumes or creates the cost of the rent. With this driver the individual product’s costs can be reduced by creating longer runs which leads to fewer batches and there for reduces the changeover time that is required after and before each new batch. Another possible driver would have been the produced kilograms so that the cost would have been divided evenly between the products. This was, however, rejected because run + changeover time was more accurate driver than produced kilograms. Run + changeover time created some difficulties with the CBB lines' allocation because the required information was not recorded. Therefore the cost was allocated to CBB's products according to kilograms produced. This same method is applied in the situations where the required information is not available (run time, run + changeover time and no. personnel).

3 Cleaning - Process level

For cleaning activity percentage was used as an activity driver to allocate costs from cleaning activity to production lines. The production line –phase was included to the allocation process because some of the production lines cause more of the cleaning costs than other lines. To be fair to all products, no matter which production line it is produced, percentage was used to divide the costs so the cost would be assigned to the right production line that has caused the cost. The untargeted cleaning costs are allocated to production lines according to the produced kilograms.

From production line the cost is further on allocated to the products according to number of batches produced. This driver is used because the cleaning has to be done between different products so the products stay intact and do not contaminate. If the share of different production lines' cleaning cost is not available, then the costs are to be allocated to products according to produced kilograms.

4 Depreciation of machines - Process level

Because depreciation of machines is more a process type cost, like cleaning costs are, it needs to be allocated to the production lines before it can be allocated to the products. The cost are allocated to production lines according to production lines' own depreciation. This allocation cannot be based on the traditional ABC approach as was explained in chapter 2.1.2. The production lines own depreciation costs are allocated to them untouched but the other depreciation needs to be allocated to the production lines also. This amount of other depreciation costs is allocated to production lines according to production lines share of produced kilograms as is done with maintenance costs.

The costs from production lines are then allocated to products using activity driver ‘run + changeover time’. This driver was selected because it shows the amount a product uses the machines and therefore is responsible of the costs. Revenue was one of the optional drives that was considered, but then the run + changeover time was seen to be more fitted and the cost was seen to be caused by the time the line or machine in the line was being used rather than the produced amount of products.

5 General building costs - Organizational level

General building costs are, like administrational costs, organizational level costs. These costs are created because of the building maintenance. These costs are affecting all of the products equally and can therefore be allocated straight to the products. There were only two activity drivers considered for allocating these cost: myks –produced and kilograms –produced. Both were good options but with produced kilograms the results were more satisfying in this situation.

6 Maintenance – Buildings and others - Organizational level

The maintenance costs of buildings and others was divided between production lines with the same principle as building rent. The more the production line uses floor area the more costs it should carry. Therefore square feet was used to allocate the costs to production lines alongside with produced kilograms. From production lines the costs were allocated to products according to produced kilograms. Each product causes the maintenance costs of the building equally and therefore the produced kilograms was a fair activity driver to allocate these costs to products.

7 Maintenance – Machines - Process level

Maintenance costs can be allocated to production lines according to their own created costs. The production lines’ caused maintenance costs are recorded and can therefore be allocated straight to the individual production line according to their share of costs in a same way as depreciation costs are allocated. The untargeted costs are allocated in relation to produced kilograms. Further on from production lines the costs are allocated to individual products according to their run time. The assumptions for allocating the cost from production lines to products that are made are: the longer the product is produced the more it will create maintenance costs and the longer the line is working the more likely it is that it will need some maintenance work. Therefore run time is the best possible activity driver to allocate maintenance costs from production lines to products.

8 ICT related administrational activities – Organizational level

ICT related an administrational activity is an organizational level activity and the best way to allocate these costs is by the kilograms produced.

9 Logistics - Organizational level

Logistics costs are an organizational level activity and the best way to allocate these costs is by the kilograms produced.

10 Procurement - Batch level

Procurement is tightly connected to the amount of material resources used. The more material is used the more procurement is required. Therefore the best driver is to use produced kilograms to allocate the costs from procurement activity straight to the products leaving production line –phase out of the calculations. Produced kilograms is a telling driver because the more the product consumes material the more it creates work for procurement. Even though procurement is a batch level activity, number of batches would not be a fair driver because of the different run times of the batches. Therefore the produced kilograms is the best suitable driver for this situation.

11 Production planning - Batch level

Production planning is different from procurement even though both are batch level activities. For production planning the number of batches is a good and describing driver whereas it was not for procurement. The costs could be allocated straight to products with the number of batches produced. The production planning costs are created by planning when a batch should be produced and how long it should or how long it can be driven. The more the batches the more the planning of the time table takes and therefore the more of the costs. However, the number of batches should also be dependable on the length of the batch. Because that information is not available the costs are firstly allocated to the production lines according to the kilograms produced to be fairer to different production lines. Some production lines produce a lot of small batches whereas some produce less but longer batches (according to the run time of the batch). Therefore these costs are firstly allocated to the production lines according to the kilograms produced and from there to the products according to the number of batches produced.

12 Quality control - Batch level / Unit level

The cost of quality control is ultimately caused because of legal reasons and keeping customer satisfaction. Quality control is dependable both on number of produced batches and kilograms but not on production line. It was seen that the more products are produced the more quality control is needed. Also the more batches are produced the more quality control is required. This activity's activity driver was hard to select because of the complexity of the activity. After trial and error number of produced kilograms was selected as the most suitable driver. 'Kilograms produced' was selected even though it was seen that quality control is dependable on the time the product is produced more than it is about 'kilograms produced'. However, the information about run time was not available for all of the products and therefore number of produced kilograms was selected.

13 Resource planning - Batch level / Unit level

Resource planning is dependable both on number of people working on production line and also on number of people working on with a specific product. However, number of personnel working on a specified production line is not available and therefore the costs are to be allocated straight to products without production line - phase.

Because the activity is dependable on the personnel working on the unit, the most suitable driver to allocate these costs to production lines would be the average number of personnel working on the product. The more the product needs personnel, the more it will burden the resource planning. However, also the time the product is produced should to be taken into consideration. Therefore the driver to be used to allocate these costs to products is 'standard work hours per product'.

14 Supervision of work - Process level / Unit level

Supervision of work is caused by the need to supervise the production. The supervision is both process level: the process need to function properly, but also a unit level type of an activity: all produced units/products need to meet set expectations. Therefore to allocate costs fairly they need to be first allocated to production line. The best driver to allocate these types of costs would be 'drive + change time' –driver. This driver takes the production lines productivity into consideration and allocates the costs according to the usage of the line: the longer the line is in use the longer it will need supervision. However, with this activity a problem occur: not enough information to allocate these costs according to the selected driver. Therefore with this activity as well as was done with resource planning: straight to the products with 'standard working hours per product'

15 Supply Chain Management - Organizational level

Supply chain management is an organizational level activity. This activity is same type of an activity as administrational activities is. All of the products benefits from the activity and all of the products create costs similarly. Therefore the best driver to allocate these costs to products without production line is 'produced kilograms' or 'myks'. 'Produced kilograms' was selected as the activity driver for no other reason than clarity and for it being more understandable.

16 Technics - Organizational level

Technics is an organizational level activity and therefore it effects all products equally. That is why produced kilograms divide the costs fairly to the products.

17 Unused floor-capacity - Organizational level

Because the cost of unused floor capacity is not caused by the production line itself, the cost can be allocated straight to the products without production line -phase. Being an organizational level type activity its costs need to be allocated evenly and fairly to products. Therefore kg produced was selected to allocate these costs to products. 'Produced kilograms' does not create any unwanted results and it is fair to all produced products by allocating each produced unit the same amount of costs per kg. That is the fairest way to allocate these type of organizational costs and therefore it is used.

18 Waste management - Organizational level/batch level

Waste management is not only an organizational level activity but also a batch level. The majority of waste production is in correlation to produced products. Therefore production line -phase should not be needed in the allocation process. However, to be fair to different production lines the costs are firstly allocated to production lines according to the kilograms produced as is done with activities 11, 13 and 14. The other notion in waste management is that it is in correlation with the number of produced batches: the more batches is produced the more waste occurs. The best indicator can be formed when a generalization is made: number of batches defines the amount of waste occurred. It is realized that some products create more waste than others and some products dough can be used with the next products' production and therefore the firstly produced product's waste is practically undistinguished. Because the amount of waste each product produces is impossible to determine exactly so the 'number of batches' was seen sufficient enough to allocate the costs as fairly as possible.

In summary the activity drivers used in allocating costs from activities to production lines and further on to products are: *run + changeover time, run time, evenly assigned, kg produced, myks produced, number of batches, number of personnel, percentage (with different variations), standard working hours per product and square feet.* The variety of the drivers is needed because of the differences in activities. Like is said (chapter 3.4) 10 to 30 drivers are sufficient. With these selected drivers the allocation can be made with relatively fairly. The allocation model was built with the fact in mind that if there is later on noticed some other, better, drivers they can be added to the model. **Appendix 3** shows a detailed table of the drivers and activities, about how the allocation is based for each cost pool.

5.5 Allocating costs

After all the preparation has been made, resources, drivers and activities selected, it is time to start allocating costs to products. The cost allocation starts on deciding which costs will be allocated. The costs to be allocated are already selected but the time period still needs to be defined. After discussion it was decided that there were four possible time periods from which to select. These periods are presented in **figure 9**. Note that the numbers presented in the calculations are modified from the original statistics and therefore some of the analysis presented are only suggestive.

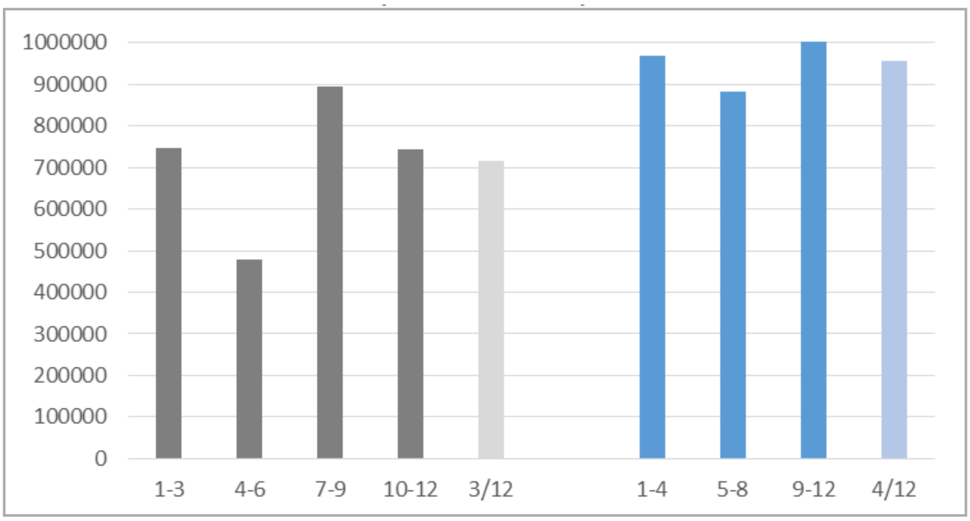

Figure 9. The amount of overhead costs presented with different three and four month periods and average cost for three and four month periods.

Figure 9 illustrates the differences between different monthly periods. With four month periods (1-4, 5-8 and 9-12) the costs are more evenly spread between periods than with three month periods (1-3, 4-6, 7-9 and 10-12). For instance, the difference between the largest and smallest sum of costs with three month periods is approximately 46 %, whereas with four month periods the biggest difference is only

13 %. The differences between periods can also be seen with individual products. Using two different breads as an example, **figures 10 and 11** illustrate the differences in product cost between different periods while the production stays intact. The dash lines in figures shows the cost (€/kg) with the average overhead cost of three and four month periods.

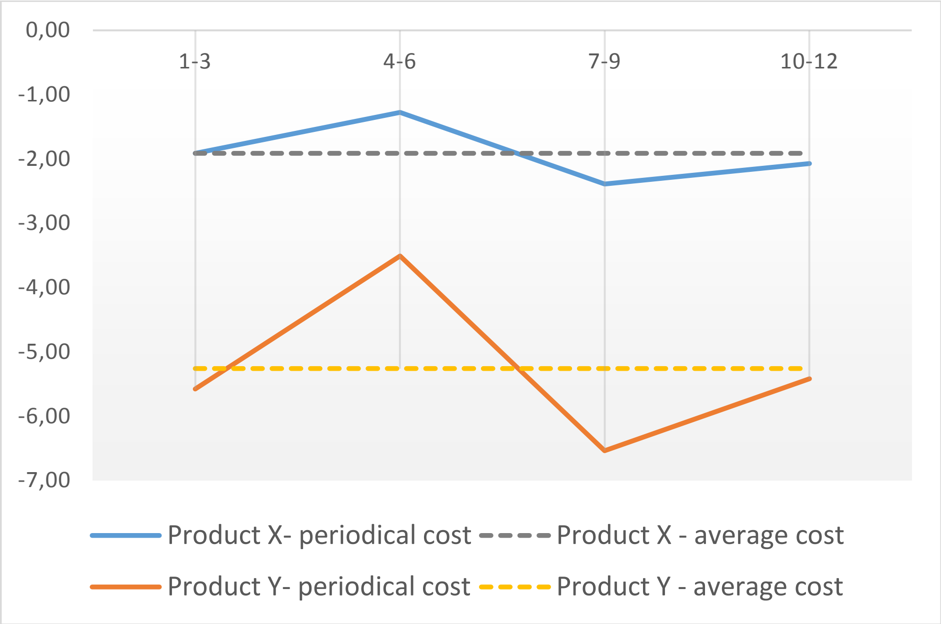

Figure 10. Product cost €/kg when fixed overheads change by 3 month period.

Based on the results of **figures 10** above and **11** below, it could be said that the average cost for both three and four month periods are better choices than the individual cost periods. Firstly it is easier to understand and calculate, but secondly and most importantly average cost is fairer. Some of the overhead costs, insurances for instance, are paid only one or two times a year which shows in greater period costs (see **figure 9**, periods 1-3 and 7-9). It is not fair to products produced within those periods to carry all the extra costs. It would create unrealistic and undesirable results that could in worst case scenario lead to dropping some products from production. These costs affect the whole year and therefore they should be divided evenly between periods. The fairest solution is to use average cost so all the costs are divided evenly between produced products and that way the allocated amount of cost would not be dependable on the period product is produced. With those reasons an average cost period is recommended to be used.

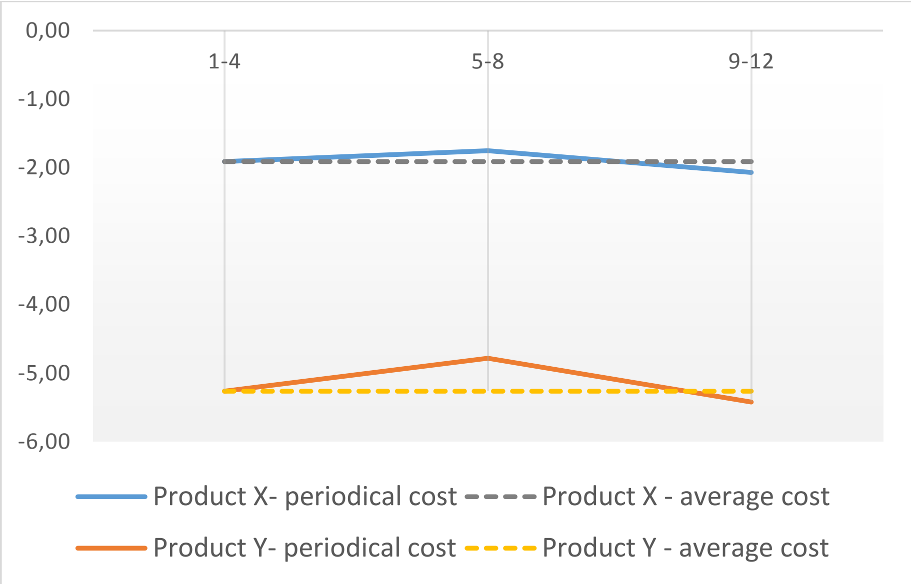

Figure 11. Product cost €/kg when fixed overheads change by 4 month period.

Sensitivity analysis

An optional 'demand forecasting' -feature was originally included to the model with which a sensitivity analysis was created. Later on the feature was removed because at the moment there was seen no longer an additional value with the usage of it. Two different single-variable sensitivity analysis were created for two different scenarios with two products. The analyses for changes in production and changes in total amount of overhead costs are presented in **figure 12**. The analysis shows the changes in product's overhead cost (€/kg) when changes in customer demand lead production either to increase or decrease and the changes when total sum of overhead either increases or decreases.

For instance, with three month average when overhead costs decrease is 4 % the products share of total costs is reduced approximately 0 % for Product X and for Product Y 2,5 %. The change for Product X is low, close to zero, because the production volume of that bread is quite small. For Product Y the change is more easily to detect because of the greater volume in production. The changes with four month average are approximately the same as are with three month average.

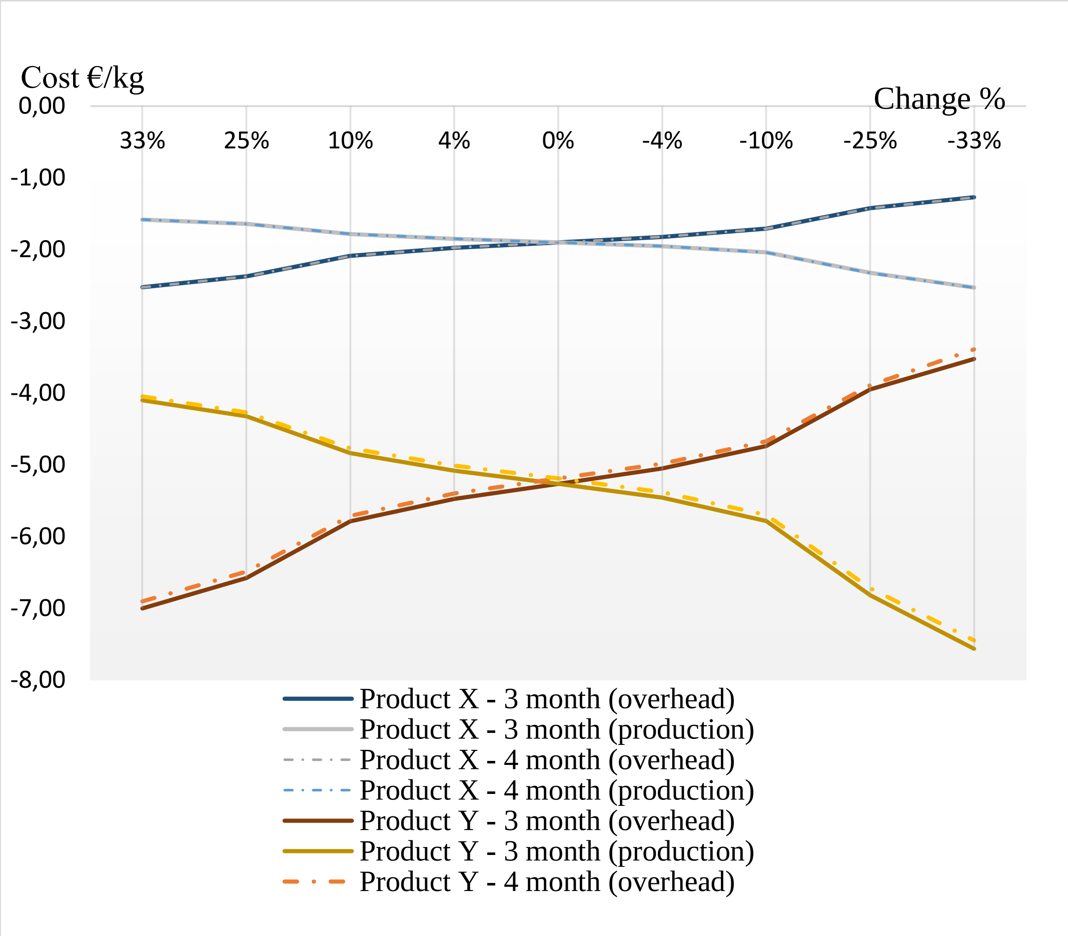

Figure 12. Changes in product cost when overhead costs and production volume varies.

As can be seen in **figure 12**, especially with Product Y, the longer the observation period the lower the share of total overhead €/kg but otherwise there are no significant differences between three and four month periods. There, however, are some factors affecting the period decision: seasonal products and campaigns. Some seasonal products are produced only during a specific month or months and therefore their production affects other products production by lowering their share of overhead costs. Depending on how often and accurately seasonal products and their costs need to be calculated the period selection can be made. The most accurate results could be achieved by using one month period, but that would not necessarily create any additional value for the company.

Based on the data available, results, discussions and requirements of the model the recommended time period to be used is four month. This is decided because 1) there are no significant differences between four and three month periods, 2) with four month period the seasonal products will get their cost as fairly as with three month periods, 3) the updating period is in line with other programs' similar updates periods and most importantly 4) it suits the purposes of the end users.

However, if the user were to use 12 month reference period the results would be same for products produced at the beginning and at the end of the reference year. With the shorter periods the results referring to same products will differ depending on the reference period. Therefore, depending on the available cost information, if it were possible to achieve all the required information, the recommended reference period would be 12 months.

5.6 The problematic of capacity

Capacity is still one of the problems in the constructed model. At this point the capacity is not added into calculations with the best way possible. The price of unused capacity is taken into account only with building. The capacity should also be included with the production usage and depreciation. They were not included because of the time limit to construct the model and some occurred difficulties on receiving satisfying results. With more specific capacity knowledge the production planning could also benefit from the results of the created model.

However, some steps are taken with capacity calculations within the model. According to Olhager et al. in chapter 3.6, the changes in demand affect the capacity usage and therefore the capacity change should be included into the model. That is why an additional feature was originally included into the model so the possible future changes in production (or in demand) show the effect on products' cost. With some further development this feature could be used as a help tool with production planning. The changes in production could show the amount of unused or available capacity. That way the production planner could see the machine capacity's potential and plan with better knowledge. It can also be used as deciding factory of company's capacity strategy: is it economical to the business to use excess capacity policy or is it too risky? This, as said, can be seen as part of the model's further development if necessarily. However, with the knowledge of received from experience and literature excess capacity policy is a safer option than lacking method because of the customer demand. If the company does not have enough items to sell the customer will change to other supplier who can guarantee an undisturbed distribution. Therefore with better understanding of the capacity 1) the changes in the surrounding world could be met with better knowledge, 2) the results could be more satisfied and 3) surprises less intimidating.

6 RESULTS AND DISCUSSION

6.1 Final structure of the model

As a result the constructed model includes the basic steps of the ABC with some variations. It could be said that the constructed model is some type of a hybrid model that applies methods both from ABC and traditional cost accounting. Those costs that could not be assigned in a typical ABC allocation method are added to the products with other methods (depreciation, for instance). The allocation model was constructed with Excel-based model and the final structure of the model is presented in **figure 13**. Analysis of the model are discussed within this chapter.

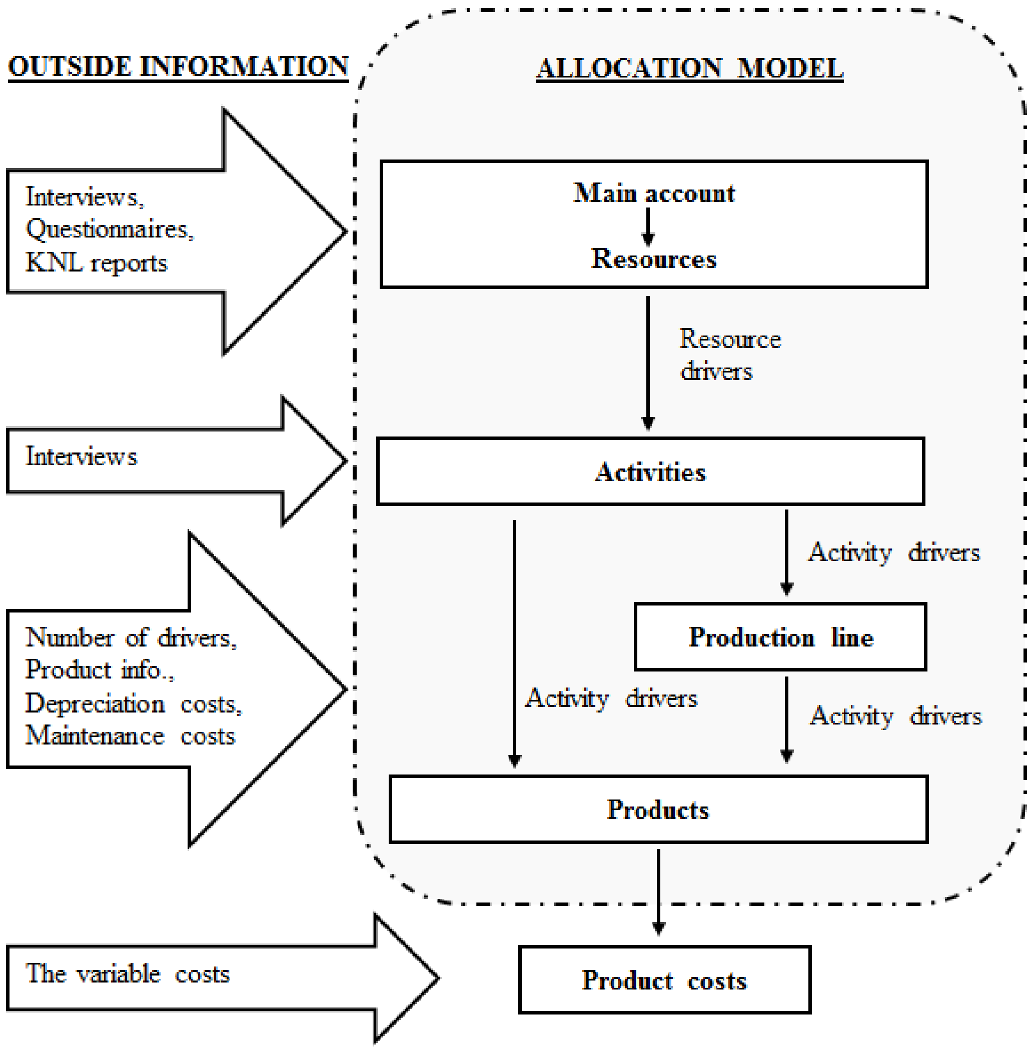

Figure 13. The final structure of the constructed allocation model.

The final structure is the combination of the two presented models (**figures 4 and 8**). The constructed model **in figure 13** shows the allocation steps for the costs and the information route from outside sources the model. As can be seen from **figure 13** the constructed allocation model, with different allocation routes, is created. The best way to allocate all costs was to take individual aspects of the costs into account. In the first phase the costs were grouped from production unit's cost center to specified resource accounts to help the ABC process. In the second phase the resources were allocated to activities found in the production unit by interviews. The first allocation from resources to activities followed the principles presented in chapter 5.4.1.

The next phase was to allocate the costs from activities to production lines. The driver ratios to allocate these costs came mainly from product information - interleaf. The drivers to allocate these costs were selected in a way presented in chapter 5.4.2. Some of the costs were best to allocate straight from activities to products and some of the costs required production line –phase. The production line divided the costs more realistically first to production lines and then to products. Some costs, cleaning expenses for instance, were such costs that needed the production line allocation phase first because some production lines caused more costs than others. Also depreciation costs were not allocated with basic ABC methods, but they needed some traditional cost accounting before they were introduced to the process. After the selection of drivers, driver ratios and finally allocations, all the required costs have been assigned to the products in the best way possible within the limitations of this model.

The aim of this model was to construct the model in a way that it is easy to update. Therefore all the information matrixes were implemented in a way that they are presented in same form as (KNL) reports. That way new information can be easily copied to the matrixes. Also the appearance of the model is important. The constructed model includes several different interleafs where the information is gathered from to different calculations. All interleafs unnecessary to updating or controlling the model are hidden so the appearance of the model is more user-friendly.

There are several main interleafs on the model. One of them is cover, where all the instructions on how to use the model are presented. One of the most important interleafs in the model is the decision making page. From that one page all of the allocation decisions can be made. That page also shows the users with which rules the allocation is based on. The most important interleaf gathers all the results into one. From that page the end result can be seen: the overhead cost for each product in €/kg format, as was required. There is also a possibility to study the results by activities with wanted products. **Figure 14** presents one of the product's costs of activities with a pie chart. It shows how the costs of different activities are divided with this selected product.

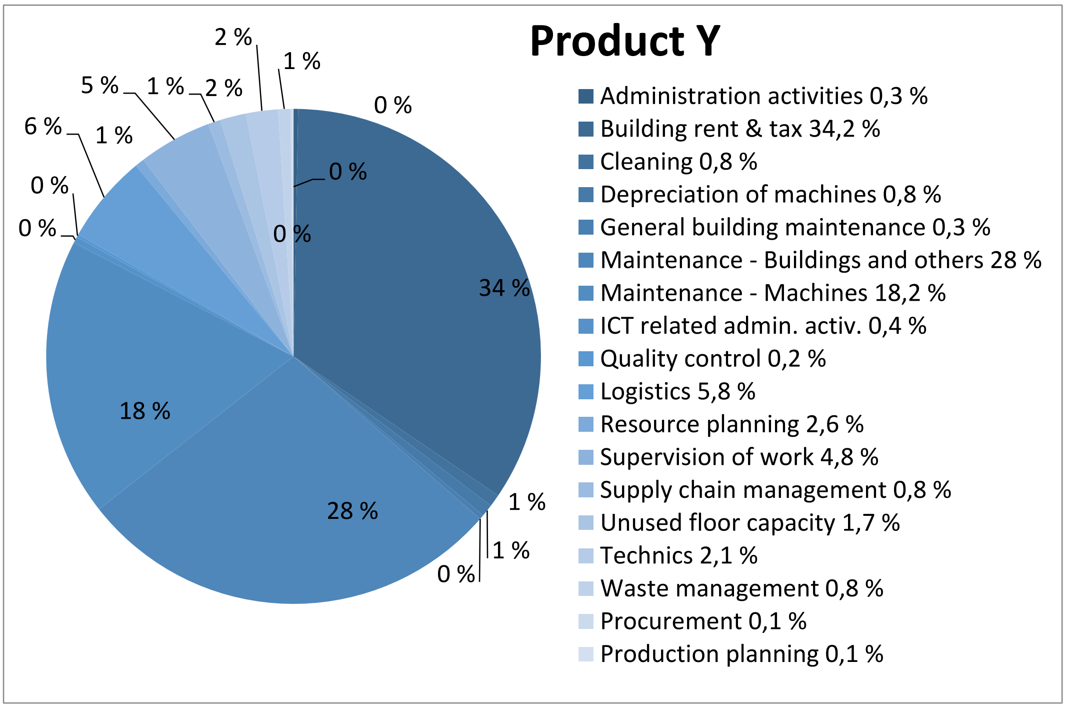

Figure 14. Modified share of costs by activities: Product Y.

By presenting the results in a way shown in **figure 14,** it is easier to shape a picture on how the costs are formulated and why the costs are divided as they are. By studying the share of different type of costs and drivers allocating those costs, the causality can be seen. By studying this type of information the cost of production planning can be reduced by lengthening the production time and reducing the number of batches (because the cost is caused by the number of batches produced), for instance. By studying the end results through activities, unsuitable driver or drivers can also be detected.

The model is constructed in a way that the driver selection made at the first time does not need repeating. If the drivers have been seen to fit the purpose and the results are satisfactory there is no need to change the drivers. However, if there occurs some major changes or an updating is required then the driver selection need to be re-evaluated. With the knowledge gathered within this limited timespan the best possible driver selections were made following theory 3.4. The only updating, in addition to drivers, are the updating of the cost data and product information. The updating period for the model was also studied by sensitivity analyses and based on the results gathered, the best updating period for the model was seen to be four months. The updating period could be even longer (preferable 12 months) if the collected cost data and product information is in correlation to the inspection period.

Although the model is built to suit especially this one unit, the test results from test units tell that the model can be modified to other similar units as well, in a way that was pursued. That is possible because of the set requirements that were introduced at the beginning of the process were followed through. The alteration possibilities on the model’s drivers and driver ratios enable the model’s function with other units as well. Also the driver selections were made keeping the different products from different units in mind. In addition to the results received from the model, the model does not only allocate costs to cost objects and create casualization between overhead costs and products producing fuller product costs, but the results of the model can also be used in IFRS based stock value creation.

6.2 Comparison to other studies

In literature ABC has been promoted as the up and coming cost accounting method that has been adopted to various industries (e.g. Tsai 1996; Al-Qmiri and Drury 2007; Ben-Arieh and Qian 2003). However, according to some studies (Askarany and Yazdifar 2012; Al-Qmiri and Drury 2007) the rate for adopting ABC has been reported quite low. In the cases when the ABC was adopted the results gained were positive. Like in this study the results in Faraji's et al. study (2015) shows that adopting ABC the allocation of overhead costs improves.

In the 90's an Australian company started losing its customers to other suppliers. The problem was seen to be within the existing accounting system. The accounting system did not provide appropriate and sufficient information and therefore they decided to implement ABC. (Sohal and Chung 1998, 140 – 141) According to the study, during the implementation process there appeared same problems as occurred during this study: timing issues, defective cost information and difficulties in data gathering. In addition to difficulties in Sohal and Chung's study (1998, 142) the results this Australian company received were similar to this study's results:

- More accurate information on costs
- Problem areas can be identified easier
- Possibility of reducing the portion of overhead

Groot's study (1997, 15) of Dutch and US companies points out that the results received by ABC are mainly used to calculate product costs like is done in this study. The similarities between information usage with Sohal and Chung's study (1998) and Groot's (1997) was that the ABC information is used in improving production efficiency and identifying cost reduction opportunities. Those same things can be received by exploiting the results of this study. Overall it can be said that the problems occurred and results received in this study are in correlation to other similar types of studies.

There have been some similar product costing development projects within other Finnish industries. For instance, the studies of Riihimäki (2014) and Pinomaa (2013) show that there is need for improving product costing in different types of enterprises. The results of the studies show that there have been improvements in accounting and in the efficiency of the manufacturing processes by adopting ABC as a part of the company's cost accounting.

6.3 Further development and recommendations

One of the allocation model's least accomplished features was simplicity in updating the model. Even though the cost data was constructed in a way that that it followed the main guidelines of the existing reporting, the amount of different reports needed to update is rather high. Also the accuracy in capacity calculations was not as high as was wanted. Therefore the recommendations for further developing of the cost allocation model are:

1. Find new simplified ways to collect the cost information required to calculations by developing existing processes within the production unit.
2. Make deeper analysis on cost drivers and create more accurate allocation bases.

The constructed model could be further developed by simplifying the input information. At the moment the model is not as simplified as it could be. Therefore the first recommendation requests more detailed information collection within the production unit. One of the problem areas is the CBB production line. By gathering the same level of detailed information about CBB, as is done with other production lines, the allocation would be more accurate and less complex. That would require some further development within the production unit's own cost information collection processes. For instance, production times could be traced with developing the usage of Piccolo –link. If the cost information is in same format throughout the process the easier the cost data collection would be. With that also the likelihood to errors would decrease.

The second recommendation gives a take on deeper analysis on cost driver selection. This could be done by interviewing more people from different production units to get a better picture on different processes. The reason to do a deeper analyses on cost driver selections is a need for finding even better causalities. This could be used especially with capacity calculations because the number four on the set targets was not received. By discovering and calculating the practical or normal capacity in each unit for each production line, the amount allocated to unused machine capacity could be calculated with satisfying end results. In capacity calculations several different factors should be taken into consideration: holidays, maintenance breaks, repairs and setup times (McNair & Vangermeersch 1998, 28). By acknowledging and further developing the features affecting capacity, for instance, the allocation model could give more detailed results.

At the moment the calculations are mainly done with occurred cost information instead of budgeted. By using budgeted cost information and forecasts about production the allocation model could be used for predicting. This could be an interesting tool to help production planning, although there is a possibility that it is not practical to develop the model into that direction at the moment. First objective of the model would be the modification of the model to be more simplified and accurate than it is at the moment. After that some alterations could be considered, but it would be a case for further development. As an alternative suggestion for further development of this study, different type of cost accounting methods could be studied for other food industry enterprises. The research could be about what types of accounting methods other similar companies use: are they similar to this type of a method or how do they differ?

7 SUMMARY

Product costing should provide managers with reliable and accurate cost information for decision making processes. The bases how the costs are formed differ between different cost accounting methods and therefore proper cost information is in key position. It is important to allocate costs properly and accurately to products according to causality. The best way to implement causality is to find the right causations. Therefore in this study the surroundings for the best possible product cost allocation method was studied. Because with food industry enterprises there are low in financial returns and limited shelf lives with the products, a fair and transparent overhead cost accounting system is important to realize. However, in many organizations that could be a difficult task to conduct. Despite the challenges involved, studies have shown that ABC is a good method to allocate overhead costs to products. Without knowing what causes the cost of the product, managers have a difficult time to step in and evaluate the efficiency of the processes. With ABC the company managers or controllers can see the inefficiency of the processes and therefore they can minimalize the waste usage of resources. By choosing the right activities and detecting the most suitable drivers to allocate the costs, the best and equitable results are received.

The starting point in this study is to extend the product cost accounting in a food industry enterprise VAASAN Oy by creating a new method to allocate production unit’s overhead costs to products. The objective was to construct an Excel-based model to allocate specified overhead costs to products for controllers’ product costing purposes. The research problem is approached by literature review regarding different product costing methods. Then, seven interviews are conducted to gather professional knowledge about the case company and at the end an Excel-based model is created for the purposes of the case company. Starting point is to find what product costing method is the most suitable, from which elements the allocation model should construct, which drivers should be used and what is the best updating period. The aim is to create allocation model that creates superior product cost information and enables better product based decisions.

The allocation model is decided to create by utilizing the basic principles of activity-based costing. The constructed model is not a plain ABC –system but it also exploits traditional methods with some allocations. Therefore a hybrid allocation model needed to construct. There are numerous challenges when creating this type of allocation systems in food industry business, and regardless of the challenges, company should receive value added results. By using activity-based costing method the focus point in the allocation are activities, otherwise it concentrates on what the company does. Different resources are allocated to activities based on the activities' resource consumption and from there on to the products based on the load on activities caused by the products. Resource drivers are used to describe the activities' resource consumption and activity drivers are used to describe the load caused by the cost object.

The construction of the allocation model started by defining selecting costs to be allocated and defining the activities. The definitions and selections were based on the interviews of the production units' managers and controllers, and studying the cost information gathered from production unit's cost center and KNL. Based on the findings 15 resource groups and 18 activities were selected to be used in the allocations.

The allocation model was built with Excel -spreadsheet. The first phase in allocation was to allocate the resource costs received from production unit's cost center to set activities. The allocated costs were gathered from the previous 12 months of the accounting so the allocation is not dependable on the period it is realized. Resource drivers were selected so the costs were assigned to the activities based on their consumption and casualization. Activity drivers were selected according to the causality as was done with resource drivers. However, activity driver –selection was also based on how easy they were to use. Some drivers were rejected because the accuracy of the driver would not have been enough or the data to use the driver was partial. Based on the selections made during the process the allocations were made.

As a result of the allocation and allocation system development the products' overhead cost portions were able to calculate in more thorough way. The accuracy of the costs developed, transparency was received and cost awareness improved. Because the results of the model are in the form of €/kg, they are comparable between products, production lines and also between different production units. As a result, the variances between different products but also the shares of different activities can be studied. Based on the analyses decisions of the products can be made.

As a result of this study the research questions presented in the beginning were answered. The most suitable allocation method to be used in this food industry enterprise was seen to be a modified version of an activity-based costing method. The model will consist of different types of resources, activities and drivers. Also the driver ratios are an important part of the allocation model. The main drivers to be used in the allocations were found by studying the production unit's individual processes, and based on the processes the best available drivers were selected. The reference period in this study was selected as four month because of the information availability, but the recommended reference period for the future is 12 months.

The allocation model constructed needs further improvements and testing. The practicality of the model need to be tested by the users and based on the experience some alterations can be made. For example, new drivers can be added to the model to suit the causality in better ways. Also if the model is later on used as a part of the pricing decisions the allocated costs need re-evaluation. It will be interesting in the future to inspect how this constructed model will work out in practice and what will be received by user experience, and will the expected requirements be fulfilled.

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Suutarinen, M. (2015) Manager unit 4, Fresh
Vainonen, M. (2015) Manager unit 2, Crisp

APPENDIX 1: List of allocated costs by account groups.

61010
61020
61030
61040
61050
61060
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51015
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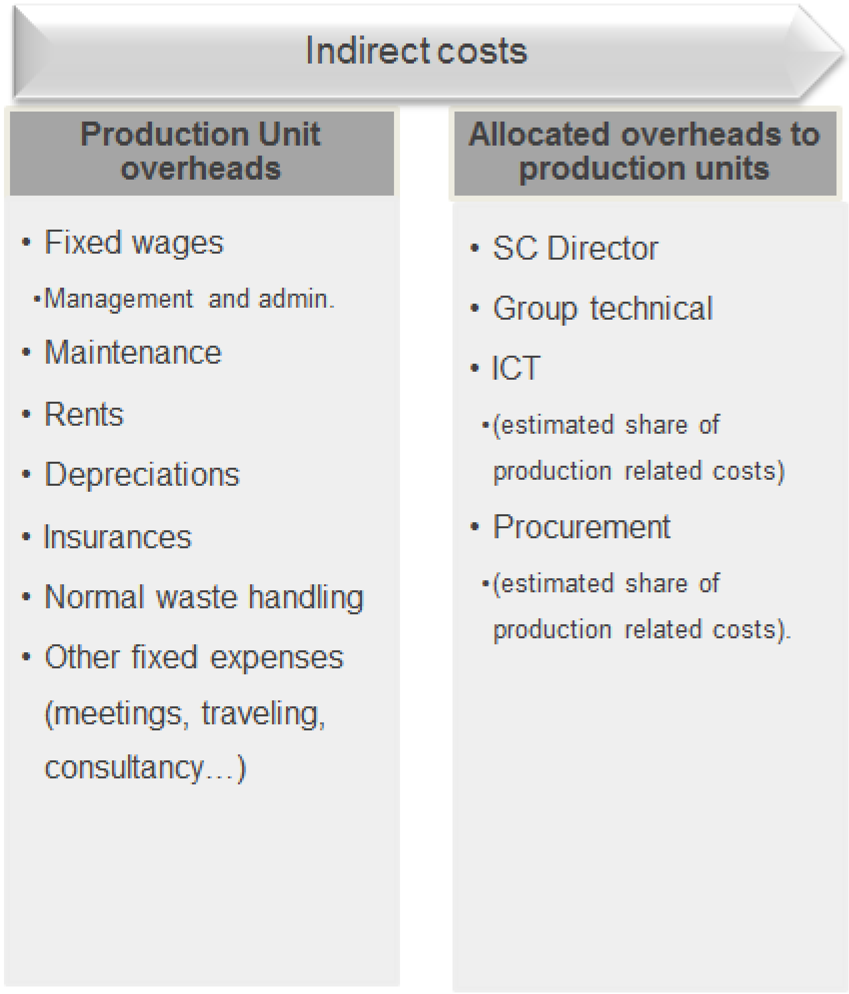
67070
67510
67520
68010
68020
68030
68050

69010
69014
69018
69022
69026
69030
69034
69038
69042
69046
69050
69054
69058
69062
69066
69070
69074
69078
69084
69090
73010
73020
75010
75040
81010
94001
94002
KP AA
KP BB
Depreciation
Group Supply Chain Management costs

APPENDIX 2: Indirect cost components in product cost (IFRS).



APPENDIX 3: The allocation principles within the model.