Samu Ketola

Developing a Distribution Pricing Model for the Case Company

Helsinki Metropolia University of Applied Sciences

Master's Degree

Logistics

Master's Thesis

7 May 2017

This Master's Thesis is the culmination of the studies that have required a lot, but gave back even more. Large scale projects at the work place combined with the studies has kept me very busy this year, and without the support of my company, university, family and friends it would not have been possible to acomplish.

At the university, I would first like to thank my instructors Dr Juha Haimala and Zinaida Grabovskaia, but also Dr Thomas Rohweder for all the support and quidance they provided. It has been a great pleasure to study under the quidance of people with such a high level of expertise from both, the business and academy fields. The constructive comments from all the classmates should not be forgetten either.

Metropolia also helped in another way. The large scale worktime measurement done by the industrial management students required lot of working hours and focus. I want to thank all the participants and their instructor Harri Hiljanen for their input.

At the company, I would like to thank Pekka Soininen, Petri Virtanen and Gustaf Elmquist for the interviews and support in this study. Special thanks goes for Jussi Peltonen, Pasi Lehtinen, Markus Hiedanniemi and Arto Nivalainen, who have first of all made my Master's studies possible and, secondly, gave a lot of support and generously shared their knowledge during the entire thesis project.

Last and maybe the most important support is from my girlfriend Eeva. Thank you for the patience rergarding the busy months that I have had lately and all the support, which have made my studying possible.

Samu Ketola
Vantaa
May 7, 2017

Author Title Number of Pages Date	Samu Ketola Developing a Distribution Pricing Model for the Case Company 61 pages + 8 appendices 7 May 2017
Degree	Master of Engineering
Degree Programme	Logistics
Instructors	Dr. Juha Haimala, Principal Lecturer, Head of Department of Industrial Management Zinaida Grabovskaia, PhL, Senior Lecturer Jussi Peltonen, National Distribution Manager

This Master's Thesis aims to develop a new distribution pricing model for the case company. The company has outsourced its distribution to several distribution contractors, which get paid through the company's distribution pricing model. The fact that the payment to the contractors that are operating in different areas and with different vehicle types, is based on the same pricing model, brings a great challenge to the equality and transparency of the pricing model. Therefore, this study aimed to revise the current pricing model with the view to possibly change into a better one.

This study, conducted as a single case study, is based on a large scale worktime measurement, key stakeholders interviews and literature review of best practice on the pricing models used in logistics. The study revealed that the current pricing model and system have got to the end of their lifecycle, and it proposes a new simplified pricing model, which is tailor-made for the case company, and aimed to be taken into use.

The new pricing model is based on the fit of the relevant elements from the three commonly known pricing models. First, the elements for fixed costs and actual transactions came from the *activity-based costing* model. Second, the new model got time-drivers from the *time-driven activity-based costing* model. Third, quality was included into the model, based on the learnings from the *performance-based logistics*.

The validation and testing phase of the study shows that the new model can capture the complexity of the activities on a sufficient level, without losing the transparency and cost efficiency. Therefore, next steps towards the implementation of the model relate to the suggested improvements to the route planning and starting the system development to support the calculation of the monthly payments for the distribution contractors.

As the distribution takes a major part of the company's logistics costs and makes a visible part of the logistics activities for the customers, the importance of the pricing model should not be underestimated. The proposed pricing model can improve the quality of the activities, without losing the cost efficiency.

Keywords	Distribution, Pricing Model, Distribution Systems, Cost Efficiency, Quality, Performance

Contents

List of Figures

List of Tables

1 Introduction

Logistics is one of the most expensive functions for manufacturing companies, and distribution is a major part of it. Due to this, companies are placing considerable focus on distribution's cost efficiency. If correctly managed, it can provide a competitive advantage for the company by lower costs and better service level than what the competitors have.

1.1 Business Context

The case company of this Thesis is one of the biggest breweries in Finland and the oldest grocery industry company in Nordic countries, Sinebrychoff. The case company has been founded in 1819 and since 1999 it has been owned by Carlsberg Group, the fourth biggest brewery in the world. Carlsberg has operations in Asia, Russia and in almost every European country.

In 2014, the company was divided into Sinebrychoff Oy, which is a sales company, and Sinebrychoff Supply Company Oy, which is providing production and logistics services for the sales company. Both companies are located at the same location in Kerava. Due to the fact that this split of the companies is more financial and to keep this report easy to follow, there will be later used only *Sinebrychoff* when referring to the case organisation.

1.2 Business Challenge, Objective and Outcome

In its distribution, Sinebrychoff is using outsourced distribution contractors. Payments for these contractors are based on Sinebrychoff's distribution pricing model, which has been used successfully for several years. However, the current activity-based pricing model has now been recognised as too complicated and difficult to maintain. There is also an assumption that the weighting of the different aspects of the pricing model are not equal to the time and costs what contractors are using for different tasks. The company's ERP-system (Enterprise Resource Planning system) and business environment have also changed a lot in the recent years and therefore the current model and the driver fee calculation system have come to end of their lifecycle.

Business challenge, which emerged as the need for this study, is thus a complex distribution contractor pricing model and system which needs to be revised. It has been recognised that because of the complex pricing model, there is no possibility to perform a competitive bidding or present in advance for potential contractors how much they are going to be paid for their services.

Accordingly, the objective of the thesis is to *develop a new distribution pricing model.*

The goal of this study is thus to conduct a well-grounded investigation on how and on what basis, the distribution pricing model should be rebuilt. In practise, this means that the study will suggest a new simplified distribution pricing model for the company, which can later be used to develop a new system to calculate purchase invoices for the distribution contractors.

1.3 Thesis Outline

The objective of the study is to develop a new distribution pricing model. However, it is limited so that the outcome of the study is a proposal on how and on what basis, the new model should be build.

This thesis is written in seven sections. The thesis starts with an introduction, in Section 1. Section 2 overviews methods and material to be used in the thesis to give an understanding on the research approach and design, data collection and analysis, and thesis evaluation. Section 3 analyses the current state of the distribution pricing model in the case company. The current state analysis starts with an overview of the case company and its distribution, continues with a detailed analysis of the distribution pricing model and ends up revealing the strengths and weaknesses of it. Section 4 is a theoretical part, where previous studies and best practise on the subject are analysed. After that in Sections 5 and 6, there are separate parts for building and validating the proposal for the new distribution pricing model. The study ends with the conclusions in Section 7.

2 Method and Material

This section describes the research approach, design, data collection and data analysis used in this study. Last, the section also presents the evaluation criteria which ensures the quality in this study.

2.1 Research Approach

The research approach selected for this study is case study. The difference between action research and case study research is that a case study begins with the researcher's particular interest in some individual phenomena, whereas action research typically starts with a challenge to act in an individual practical situation. Therefore, action researcher usually faces a two-sided issue, where the study should first answer a research question and second to fulfil a practical need. (Blichfeldt & Andersen, 2006, p. 4)

Woodside and Wilson (2003) define "case study" as an inquiry that is focusing to describe, understand, predict and/or control an individual or a phenomena. Individual can be, for example, a person, group, organization or industry, in other words, a "case". According to Yin (2009), the case study starts with posing a questions. This makes the first and most important aspect is the research design. In a case study, the research question typically takes the form of "how" or "why" question. Second, researcher typically has no control over the behavioral events of the study. Third, the case study preferably focuses on contemporary events. Advantage of a case study approach is its ability to use interviews and observations as a source of evidence. Both of these make contemporary events that cannot be found from historical data. (Woodside & Wilson, 2003)

In addition to data collection and analysis based on oral and textual sources (such as interviews, observations, investigation of the internal documents, etc), which makes a form of quantitative research, the case study approach can also include aspects of quantitative research. Quantitative research includes collecting and analysing large samples of historical data, and can also be a part of a case study. (Yin, 2009, p. 19) Usually, a case study combines data from different sources. Data can be collected from archives, questioners, observations or via interviews, and the data can be qualitative, quantitative or both. (Eisenhardt, 1989, pp. 534-535)

Even though this study has some aspects of both types of research and both types of data, the approach that this study uses can be recognised as a case study approach. This is due to the physical phenomena that the study explores, while the possible actions are left out beyond the scope of the study, as they will be based on the investigation and learning from the case. Thus the intervention can be done only after, in the second phase of the project. For this study, the research question can be formulated as a "how" question, h*ow to develop the new distribution pricing model.*

2.2 Research Design

The research design of this study is illustrated in Figure 1 below. Figure 1 shows the design of the different stages and the logic how the research is conducted. Furthermore, it shows how, and at which point, data was collected and points to the outcomes of the separate stages

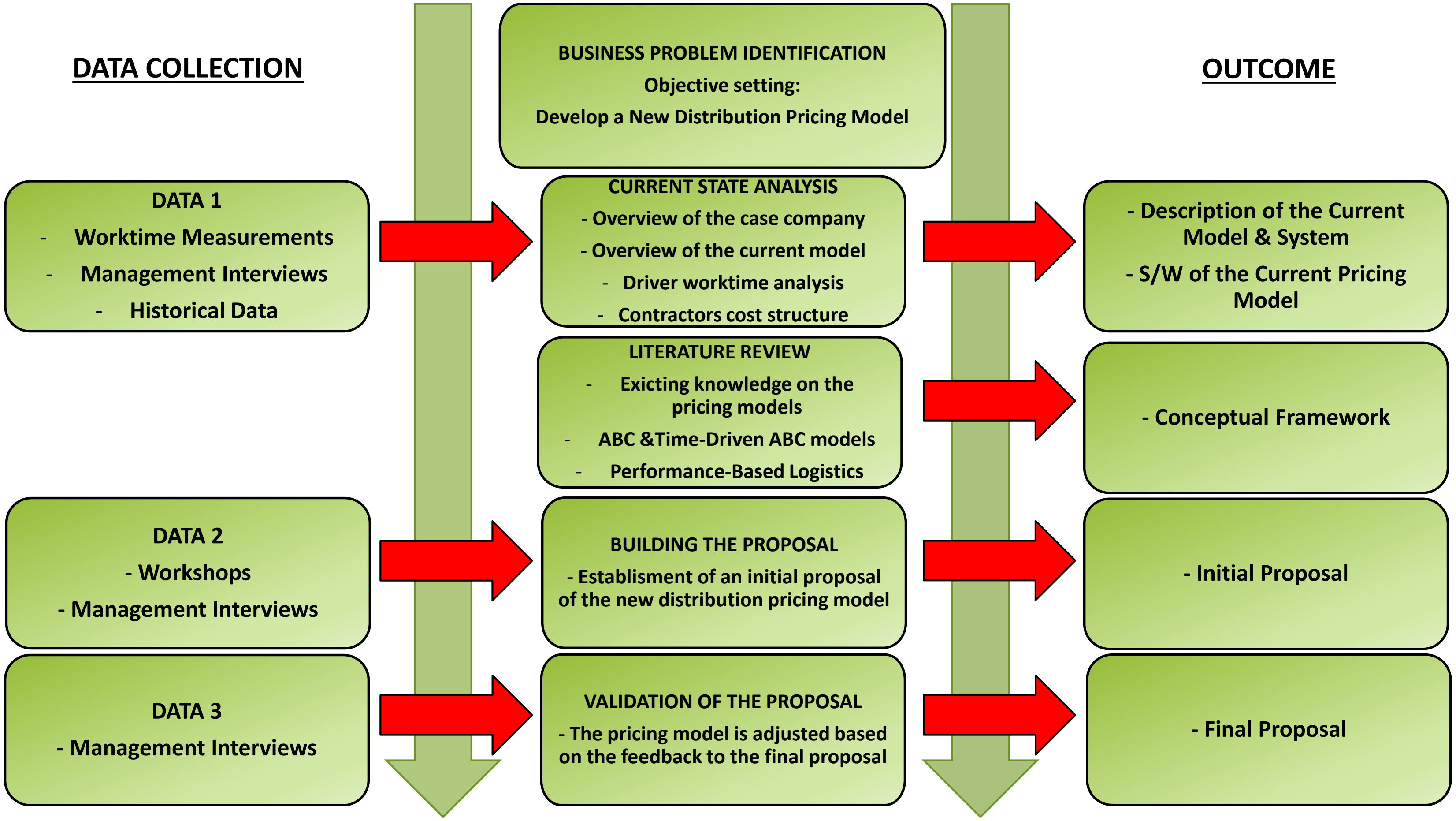

Figure 1. Research design in this study.

As illustrated in Figure 1, the study starts by defining the business challenge, which is then transformed into the objective that targets the final desired outcome, the final proposal. After the objective setting, Data 1 collection started with conducting management interviews and a worktime measurement to gather reliable data to be used in the current state analysis. Third part of Data1, the historical data, was taken from the current driver fee calculation system and from company's ERP-system. Data 1 is used to reveal the strengths and weaknesses of the current pricing model and the current driver fee calculation system. After the current state analysis is done, the study continues with a literature review. There existing knowledge and best practice on the issue are studied and used to build the conceptual framework. Based on the conceptual framework, the proposal is developed in the next stage.

Next stage of the study, proposal development, starts by collecting Data 2 from workshops and management interviews. All the collected data, as well as the learnings from the current state analysis, learnings from literature review, and the key elements of the learnings merged into the conceptual framework, are then used as a basis to build the initial proposal for the new distribution pricing model. After the initial proposal is presented to the key stakeholders and they have provided feedback on it, the study starts the validation of the proposal. Based on the validation feedback, the proposal is adjusted to its final form. After the adjustments are done, the final proposal for a new distribution pricing model is presented to the key stakeholders, who can make the decision on the next steps.

2.3 Data Collection and Analysis

In this section, all three data collection rounds are described in details. All data collected via interviews and workshops is presented below in Table 1.

Table 1. Data collected via interviews and workshops.

	Participant	Role	Data type	Topic, description	Date and length	Documented
	DATA 1					
1	Respondent 1:	Customer Supply Chain Director	Face-to-face Interview	Experiences on the current driver fee calculation system	February 2017, 60 min	Field notes
2	Respondent 2:	GBS Manager	Face-to-face Interview	Experiences on the current distribution pricing model & system	February 2017, 45 min	Field Notes
3	Respondent 3:	National Distribution Manager	Face-to-face Interview	Experiences on the current distribution pricing model & system	February 2017, 60 min	Field Notes
4	Respondent 4:	Area Manager	Face-to-face Interview	Experiences on the current distribution pricing model & system	February 2017, 75 min	Field Notes
5	Respondent 5:	National Warehouse Manager	Face-to-face Interview	Experiences on the current distribution pricing model & system	February 2017, 50 min	Field Notes
6	Respondent 6:	Senior Business Process Manager	Skype meeting	Current ERP-system analysis	March 2017, 45 min	Field Notes
7	Respondent 7:	LEO Superuser / Route Planner	Face-to-face interview	Route planning software analysis	March 2017, 45 min	Field notes
	DATA 2					
8	Participants Arto Nivalainen Jussi Peltonen	Area Manager, National Distribution Manager	Workshop	Proposal building	April 2016, 60 min	Directly to the model
	DATA 3					
9	Jussi Peltonen	National Distribution Manager	Face-to-face interview	Validation	April 2016, 60 min	N/A

As seen from Table 1, all data from the interviews and workshops is documented into field notes, so that it is possible to revise later, if needed.

All of the interviews were conducted either face-to-face or via Skype meetings. Questions used in the interviews were sent to the interviewees in advance and included to this study as Appendix 1. In addition to the interviews and workshops, data is collected also from the worktime measurement, from the company's ERP-system, and from the current driver fee calculation system. Table 2 below presents this data collection done via measurements and internal documents.

Table 2. Data collected via measurements and from the systems.

	Data source	Data type	Description	Date and length	Documented
	DATA 1				
1	Worktime measurement	Time measurement on different vehicle types and distribution areas	6 measurers measured the time that drivers used to individual tasks during their working time	December 2016- January 2017, 57 days	Field notes, which were transferred to Excel
2	Company's ERP system	Distributed volumes	Retrieved from the company's ERP-system	February 2017	Excel
3	Driver fee calculation system	Historical distribution costs	Retrieved from driver-fee calculation system	February 2017	Figure & Tables

As seen from Table 2, the worktime measurements make the biggest individual part of the data collection in this study. These measurements consist of 57 individual measurement days, performed by six measurers. In the worktime measurements, the drivers' working time was measured and the data is later used in the current state analysis. Next, Data 2 was gathered from the workshop with the key stakeholders, where author also presented the findings of the current state analysis. This session served as the starting point to create the initial proposal for the new distribution pricing model. Last part of the data collection, Data 3 includes the results of the validation and feedback session on the initial proposal and was conducted as a face-to-face interview with the key stakeholder.

3 Current State Analysis of the Distribution Pricing Model

This section analyzes the current state of the distribution pricing model in the case company. As the pricing model is highly linked to the systems and costs to the distribution contractors, these areas are also involved into the currents state analysis.

3.1 Overview of the Current State Analysis Stage

The current state analysis starts with an overview of the case company and its distribution. After that, the current distribution pricing model is analyzed together with the systems in use, the worktime measurement and the cost structure of the distribution contractors. The last part of the section analyzes the strengths and weaknesses of the current pricing model.

To conduct the current state analysis, data was collected from three main sources; (a) management interviews, (b) worktime measurement and (c) historical data from the company's systems. Figure 2 presents the data collection methods used for the current state analysis.

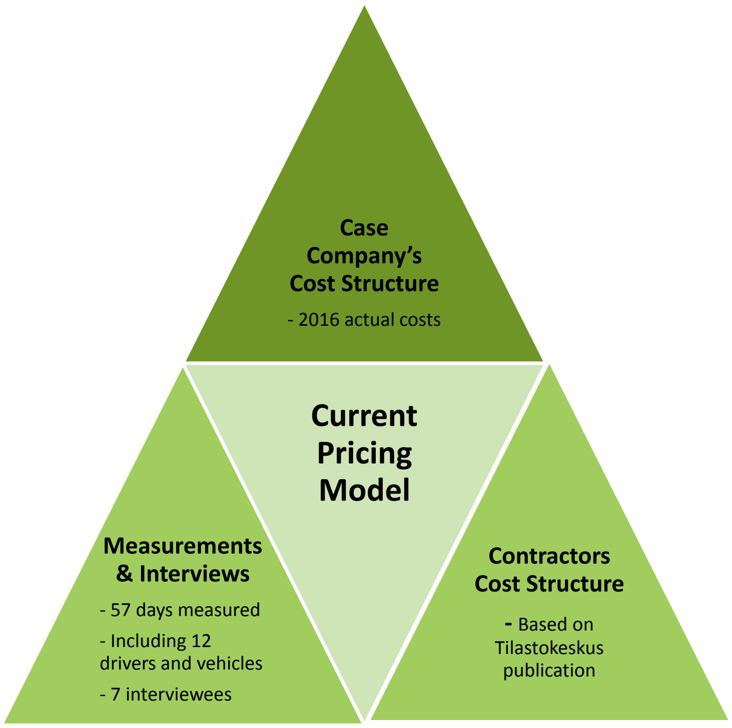

Figure 2. Data collection methods of the current state analysis.

The use of the four data sources presented in Figure 2, ensures reliable and triangulated data collection for the current state analysis. In addition to the main sources, also an open source publication is used to analyse distribution contractors' cost structure.

3.2 Overview of the Case Company and its Distribution

In 2014, Sinebrychoff delivered 375 million liters of drinks to approximately 12 000 customers in Finland. The company has divided its customers to two sections: On-Trade and Off-Trade. On-Trade includes all customers where consumption is done at the customer premises, e.g. restaurants and bars. Off-Trade includes customers where consumption is done outside of the customer premises, e.g. markets and kiosks. For these customer segments, the company is delivering a product variety of approximately 600 SKU's. For the individual customers, the company usually has 1-3 agreed delivery dates in a week.

Figure 3 below illustrates the 48 hour order-to-delivery cycle, which is in use for all regular customers in Finland.

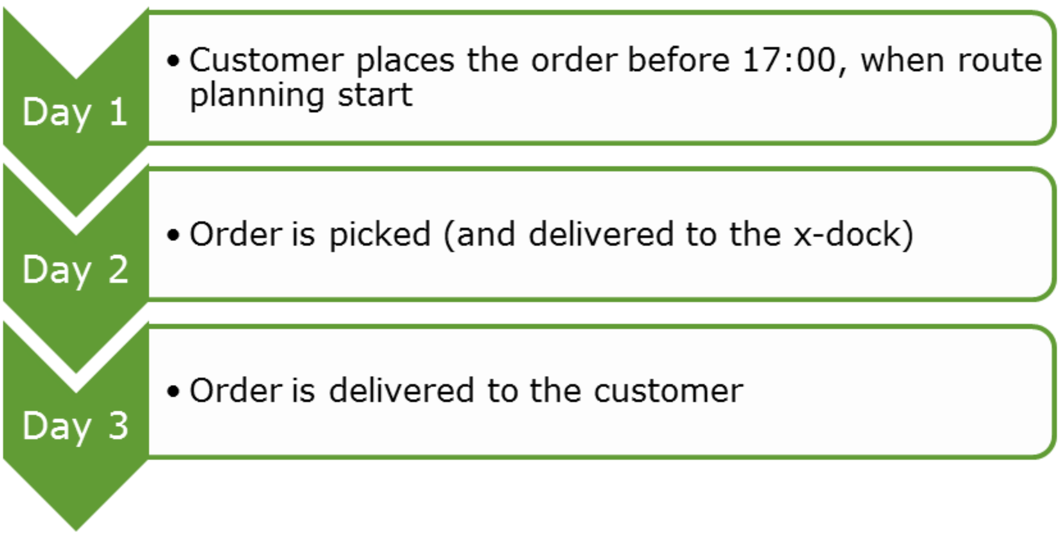

Figure 3. Order-to-delivery process in Sinebrychoff.

As shown in Figure 3, the order closure time is at 17:00 on all business days and it is also the point when Route Planners start to plan the day after tomorrow's deliveries. Route planning happens on the same day when orders are placed, and picking starts immediately after the routes are planned. Picking is finalized on the next day and the ordered goods are delivered to the cross dock, if needed. The orders are delivered to the customers 36-48 hour after the order closure time.

At the same time, with the delivery to the customer, distribution drivers are collecting the returning empties. This means that the load carriers and empty products, which are either consumed at the customer premises or returned there after consumption, are returned back to the brewery. The company is also providing shelf replenishment as a value adding service for its customers. In practise, shelf replenishment is done in agreed sites by company's Merchandiser, Driver or on co-operation of both. Shelf replenishment is part of the service in approximately 20% of the customer sites.

Presently the distribution drivers daily work can be divided into six main tasks, which are *loading the vehicle*, *driving*, *delivery, shelf replenishment*, *collecting returning empties* and *unloading* at the depot. Except *loading* and *unloading*, these are also the main components in the current distribution pricing model and used in the current driver fee calculation system.

Although the company's distribution department is working as one unit, geographically it can be divided into two, direct distribution and distribution via cross docks. The company is delivering approximately 45 % of the volumes directly from the production plant in Kerava and 55 % via 14 cross dock.

As shown in Figure 4, the cross docks are mainly located in the biggest cities of Finland.

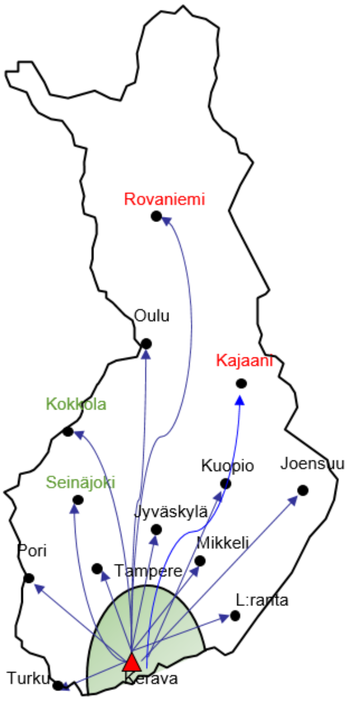

Figure 4. The company's cross docks, direct distribution area (green background) and production plant in Kerava.

In two of the cross dock areas, shown in Figure 4, the company has outsourced its distribution to one company, Posti. These cross docks are shown with green colour in Figure 4. The cross docks with red colour are joint delivery cross docks. At the joint delivery cross dock areas, the company's products are delivered to the customers within a same vehicle with Olvi and Hartwall's products, which are the main competitors of the company. This co-operation provides cost efficiency for all three companies in northern and eastern parts of Finland, where volumes are low and distances long.

All the rest of the cross docks are the company's own. At these cross docks and in the direct distribution area, all distribution is handled by the distribution contractors, which usually have 1-5 vehicles and drivers. Since distribution is handled by several small contractors, the distribution pricing model needs to be as equal as possible to all contractors, despite the distribution area where they are operating.

3.3 Results of the Current State Analysis

This section presents the key findings of the current state analysis. Results are divided into four subsections based on the key components that are affecting the current distribution pricing model.

3.3.1 Current Distribution Pricing Model

In the 1990's the company changed its distribution pricing from the hourly rate to the current distribution pricing model to reduce distribution costs, monitoring, and to increase the distribution's efficiency. Currently, the company is paying by its distribution pricing model to the contractors that are operating in the direct distribution area or from the company's own cross docks.

The current distribution pricing model is based on four key components and one additional component. All five components and actual scaling of the components are presented in Figure 5 below, which is based on year 2016's actual costs.

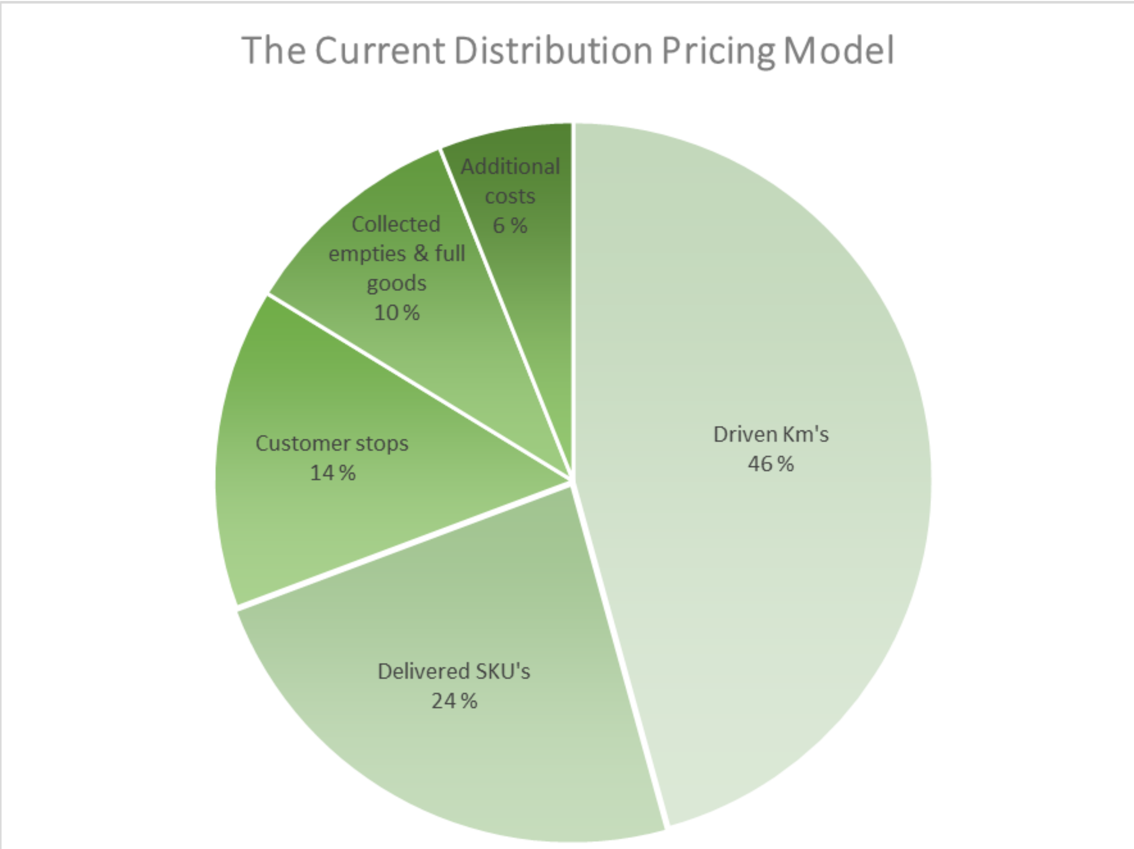

Figure 5. Components and components actual scaling in the company's current distribution pricing model.

As seen in Figure 5, 46 % of the distribution costs are coming from the driven kilometres, which makes it significantly the largest cost component of the current pricing model. In the current model, value of the *unit price* per kilometre that is payed to the contractors, is based on the quantity of driven kilometres and vehicle size. Therefore, for vehicle that is driving a lot of kilometres in a month, *unit price* per kilometre is lower than for similar vehicle that is driving less kilometres in the same time. This way the payment of kilometres conforms to different distribution areas. In other words, it is taking into notice the difference between urban and rural areas, in a sense of time used for driven kilometre.

According to the interviewees, driven kilometres have too much value in the current distribution pricing model. This presumption is based on a point that the distribution contractors' costs on driven kilometres are not as high, as the scaling of those are in current distribution pricing model. Another recognised issue with the driven kilometres is that it is very difficult to monitor that drivers are reporting driven kilometres correctly.

Delivered SKU's have a scaling of 24 % in the current pricing model. It is consists of 14 different product groups which are including approximately 600 SKU's. Payment to the distribution contractors on delivered SKU's is based on the fixed price of the product group and the quantity of delivered products of that group.

For the payment on customer stops, the company has two price groups. First group has a higher price and is set up to be used for customers in the city centres. Second group, with a lower price, is used for all the rest of the customers. Both groups have the fixed price, and when that price is multiplied with the quantity of customers sites visited, the output is the payment for the contractors. With the scaling of 14 %, the customer stops make the third biggest component on the pricing model.

In addition, 10 % of the payment to the contractors is coming from the collected empties and full good returns. All the returning SKU's have been divided into 22 product groups. Payment to the contractors is based on the fixed price on the material group and the quantity of collected items on that group.

The smallest component on the pricing model includes all additional costs that are paid to the contractors. Additional cost can be anything extra ordinary, but there is also many elements that are paid to same contractors every month. These elements are payments for trailer, second shipments of the day, merchandising and raised kilometre price. All of the components have fixed prices and are agreed with individual contractors, except for the payment for the second shipments which is mutual for all.

As the different vehicle types are used to deliver goods to different types of customer sites, there are differences in the scaling between the vehicle classes. Table 3 presents the scaling of the components in the current distribution pricing model, when broken down to individual vehicle classes Also, the range inside the components is presented in the table.

Table 3. Components of the current distribution pricing model broken down to vehicle classes, and the range between vehicle classes inside the individual components.

Vehicle class	Delivered SKU´s	Customer stops	Driven Km´s	Collected empties & full goods	Additional costs
B	18 %	19 %	33 %	7 %	22 %
C	20 %	20 %	28 %	8 %	24 %
D	17 %	20 %	48 %	7 %	9 %
E	26 %	27 %	32 %	8 %	7 %
F	24 %	22 %	43 %	8 %	4 %
G	25 %	16 %	39 %	11 %	9 %
H	26 %	18 %	40 %	10 %	7 %
I	23 %	12 %	49 %	11 %	5 %
Range	**9 %**	**15 %**	**21 %**	**4 %**	**20 %**

As shown in Table 3, there is a range of 4 - 21 % inside the components of the current distribution pricing model. The range is smallest inside the *collected empties & full goods returns* and *delivered SKU's* components, whereas the largest range is in the *driven Km's*. The range in the *additional cost* is based mostly to the payment on second shipments. This is because, smaller vehicles usually have more than one shipment in a day and therefore cause more *additional costs*.

The structure of the current pricing model is presented in details in Table 4 below. It shows the quantity of the item groups inside the components, price groups inside the item groups and the total item quantity inside the groups.

Table 4. Components of the current distribution pricing model.

Component	Item Groups	Price groups inside the item groups	Item Quantity
Driven Km's	8	2	10
Delivered SKU's	14	2	600
Customer stops	2	2	4
Collected empties & full goods	22	2	44
Additional costs	4	2	8

Based on the quantity of components, item groups, price groups and item quantities, the current pricing model is recognized as an *activity-based costing* model. Based on the interviews, the current activity-based model has been quite equal to all contractors and as the model is same for all, it simplifies the contract negotiations with the new contractors.

The model has been developed for the company in the 1990's, but it has been adjusted several times after that to match the current requirements. Changes have been necessary because of the changes in business environment, distribution model and product variety. Nevertheless, changes have made the model more complex than it was when first developed. Complexity of the current pricing model and the lack of transparency are one of the challenges that launched this study in the first place.

During the interviews it was recognised as a strength that the current distribution pricing model is following the volume fluctuation quite well, in a sense that higher volumes mean reduced c/l cost for the company. Interviewees also stated that a challenge with the current model is, that it is not treating all contractors 100% equally and it is not possible to adjust based on the distribution area. Adjustments could be needed to make sure that contractors operating in different parts of the country would get equal profit, despite the different cost of living.

3.3.2 Current Driver Fee Calculation System

As the current payment to the distribution contractors is based on large amount of actual transactions, company uses a driver fee calculation system to create invoices for the payment. It is an external system outside of company's ERP-system, and it was developed at the same time with the current pricing model in the 1990's. The system has its own master data, which is not completely aligned with the current ERP-system's master data. This is mostly because the driver fee calculation system has been developed to work with the company's previous ERP-system and it has been adjusted to match the current one only in critical areas. In addition to the master data, the driver fee calculation system is also using transactional data that is once a month manually uploaded from the company's ERP-system. The transactional data contains the actual distribution data from the previous month, which is used with the master data to form purchase invoices for the payment to the contractors.

All the changes that has been done to the pricing model after it was developed have had an effect also on the system. The system has been adjusted several times and that has led to a situation where several manual tasks needs to be done, before invoices are created. Manual work is also needed to update the system's master data. After establishing a new or changing an existing material, the driver or the vehicle in the ERP-system, similar information needs to be updated manually to the driver fee calculation system. Two issues related to manual tasks need be recognized as those are taking a lot of time and human errors occur from time to time.

The driver fee calculation system is developed by an external company in 1990, updated in 2008 and adjusted to work with the current ERP-system in 2014. The system's logic has been defined inside the company and therefore also the decision on the changes to the system can be done inside the company. Nevertheless, only small changes can be performed by the case company itself, while larger changes can be done only by the external system's developer company. In the developer company, only one employee has the knowledge and capabilities to make the required changes. The large amount of knowledge behind one individual external employee can be seen as a risk for the case company.

Moreover, the system use is not as simple and easy as it could be in the 21th century. System design and visualization is old, which makes it more difficult to use. Also, the distribution costs reporting is built to Microsoft Excel, due to the fact that system itself does not have any reporting functions. Therefore, all reports are based on Excel's SQL-queries that are used to retrieve data from the driver fee calculation system. Tracking and fixing of errors, has also been recognised as problematic. If there is an error with an individual contractor’s purchase invoice, all invoices need to be created again after the issue is fixed.

3.3.3 Driver’s worktime analysis

A worktime measurement was launched in December 2016, to be able to compare historical data of current distribution pricing model and actual work done by the drivers. Measurements were done by six Industrial Management students of Metropolia University of Applied Sciences. Measurement time included the high volume season at the end of year 2016 and the low volume season at the beginning of the year 2017. Measurements consisted on 57 measurement days, where individual students were measuring time that drivers used in different tasks.

Importantly, to get a clear perspective on the differences of different routes, vehicle types, drivers and customer sites, the measurements were done to large variety of these targets. Measurements included the measurements on 12 individual drivers and 5 different vehicle types, all operating in different routes. Figure 6 presents the drivers’ actual worktime scaling to different task, based on conducted measurements.

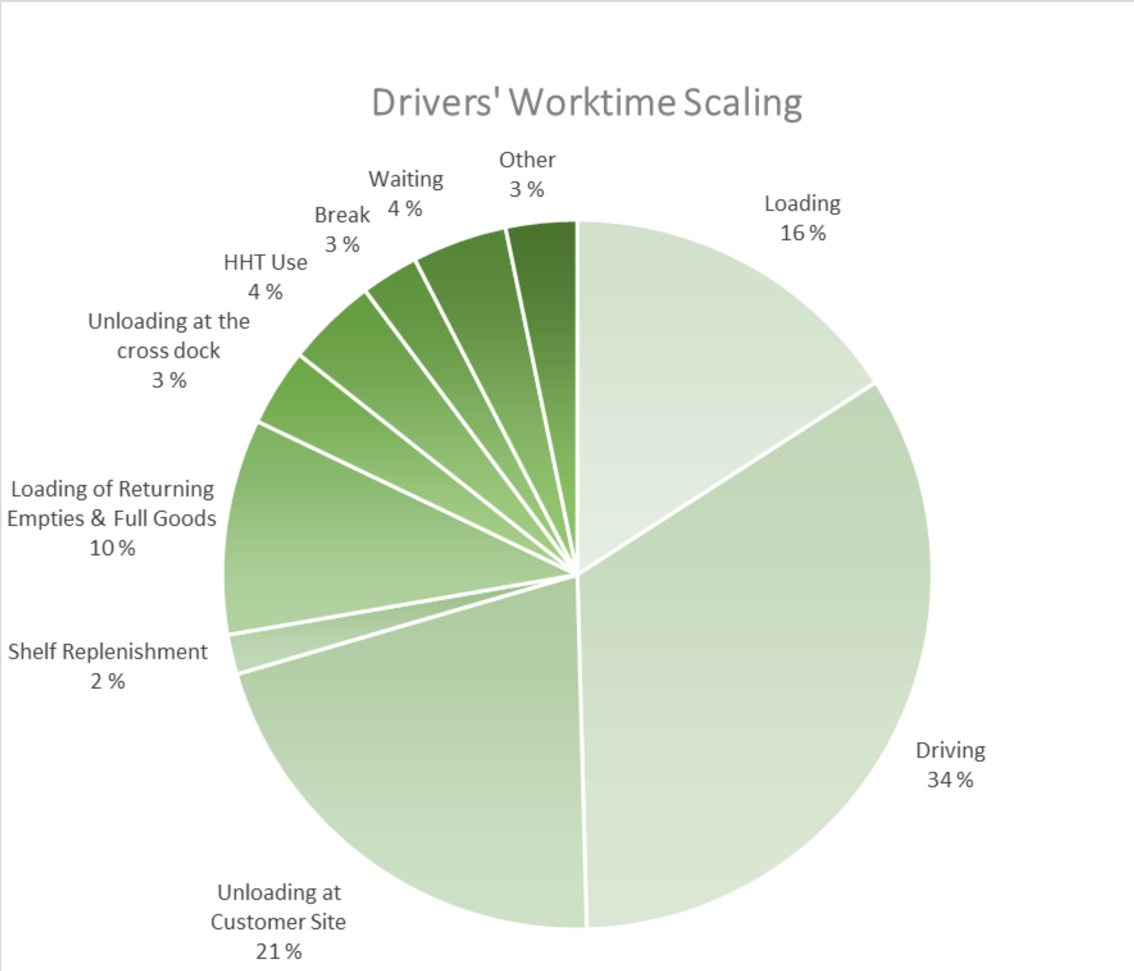

Figure 6. Distribution driver’s worktime scaling in the case company.

Scaling of the shelf replenishment, shown in Figure 6, is not comparable to all distribution areas, because most of the measurements were done in the area where company is using an external shelf replenishment operator. Therefore, shelf replenishment needs to be considered separately when creating a new pricing model. However, the company has another ongoing project on shelf replenishment, and therefore this matter is not seen as an obstacle.

In the current pricing model, the vehicles have been divided into 8 groups based on the vehicle gross weight. All groups are named with a letter. Table 5 below presents the vehicle segmentation in details and also the quantity of vehicles per group involved into the measurements.

Table 5. Vehicle segmentation groups and percentage of vehicles inside the groups in practise and in the measurements.

Vehicle group	Vehicle gross weight (Kg)	Vehicle types	Actual percentage of vehicles in the group (2016)	Percentage of the vehicles measured
B	<6000	Van, small truck	4%	27%
C	6000-8000	Small truck	2%	0%
D	8000-10 000	Small truck	1%	0%
E	10 000-12 000	Two axel truck	2%	9%
F	12 000-14 000	Two axel truck	3%	7%
G	14 000-17 000	Two axel truck	3%	0%
H	17 000-25 000	Three axel truck	27%	18%
I	>25 000	Three axel truck, Truck & trailer	59%	38%

As presented in Table 5, five out of nine vehicle groups participated in the measurements. It highlights also the differences between the actual vehicle numbers and measured vehicle number inside the groups. The differences between actual and the measurement sampling needs to be taken into count when creating the proposal for new distribution pricing model. Nevertheless, when this fact is noticed, data can be noted reliable. Table 6 below presents the measurements results when each vehicle group is divided into own section.

Table 6. Time used to different task when divided into different vehicle groups.

Vehicle group	B	E	F	H	I	Range (percent-age points)
Quantity of drivers	3	1	1	2	5	
Measurement days	15	5	4	10	21	
Loading	14 %	16 %	12 %	22 %	15 %	10 pp
Driving	47 %	27 %	42 %	22 %	29 %	25 pp
Unloading at customer site	17 %	27 %	24 %	21 %	22 %	10 pp
Shelf Replenishment	0 %	3 %	0 %	5 %	2 %	5 pp
Loading of Returning empties & full Goods	7 %	16 %	9 %	12 %	10 %	9 pp
Unloading at the cross dock	4 %	4 %	3 %	4 %	3 %	1 pp
HHT usage	3 %	3 %	2 %	6 %	5 %	4 pp
Break time	2 %	3 %	5 %	1 %	3 %	4 pp
Waiting	3 %	0 %	2 %	5 %	6 %	4 pp
Other	3 %	1 %	1 %	2 %	5 %	4 pp

As seen from Table 6, the driving time has the largest deviation between the groups. In group B, 47% of the driver's working time is consumed by driving when it is only 22% in group H. In all other measured aspects, differences between the groups were maximum of 10 percent value. This can be explained by the differences in distribution areas and the vehicle sizes. Usually the small vehicles are used to distribute to the city centres, where driving is slower. Often these vehicles have also more than one shipment per day, which means that the drivers needs to drive back to the cross dock several times a day.

Among the company's 12 000 customers, there is an equal number of individual customer sites where the products are delivered. Even though every site is different, customers can be divided into bigger groups, which can then be used to analyse the delivery durations inside the groups. In this study, customers were divided into eight groups which are presented in Table 7.

Table 7. Customer groups created for the analysis.

Customers	Customer group
Small markets: Alepa, K-Market, etc.	Market
Supermarkets: S-market, K-Supermarket	Supermarket
Hypermarkets: Prisma, Citymarket	Hyper
Gas station cafes	Gas station
Kiosks	Kiosk
Hotels, restaurants, cafes, Bars, Restaurants	On trade others
Alkos	Alko
Wholesales: Heinon Tukku, etc.	Wholesale

Division into the groups was based on the customer chain, site and ordered volumes & SKU's. When customers are divided into eight groups, differences that are affecting the distribution can be highlighted, but there is still a manageable number of groups. Customer groups are used to analyse differences in delivery durations to the customers inside the groups.

Figure 7 presents how long is the average delivery duration per SKU and per hectolitre, for each customer group.

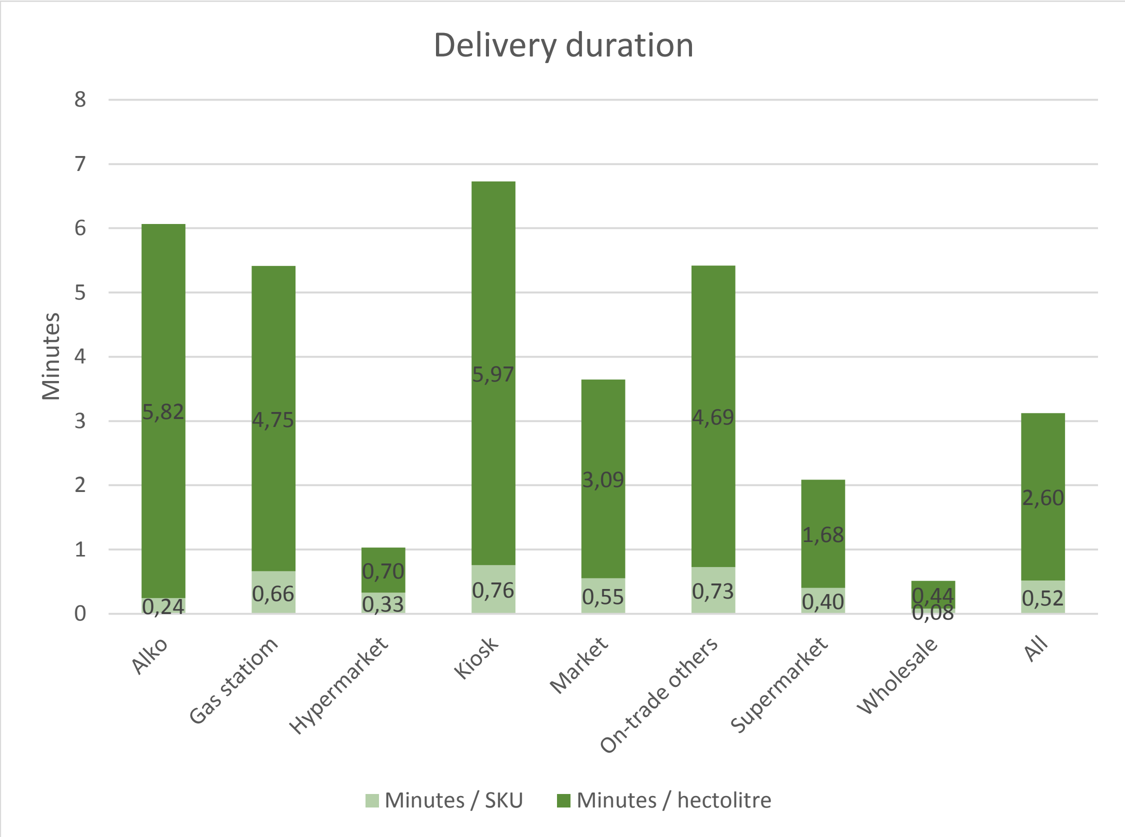

Figure 7. Delivery durations per SKU and per hectolitre.

Delivery durations in Figure 7 include the time used to unload the vehicle at the customer site, collecting of returning empties and full goods, and HHT (Hand Held Terminal) use at the customer site. It does not include shelf replenishment as it is not done in all customer sites.

As presented in Figure 7, average delivery duration for all customers is 0,52 minutes per SKU and 2,60 minutes per hectolitre. However, the durations have a large deviation between the customer groups. For the wholesale delivery duration is 0,08 minutes per SKU and 0,44 minutes per hectolitre, when delivery to Kiosk is taking 0,76 minutes per SKU and 5,97 minutes per hectolitre. Reason behind these deviations are the differences in the order sizes, ordered SKU's and the customer sites. For example, during the measurements, the average order size for hyper markets were 89 SKU's and 42 hectolitres, while for Kiosks it was 16 SKU's and 2 hectolitres. At the same, time facilities at the hypermarkets are better designed for the deliveries. There is also a large variation inside the customer groups. Table 8 below presents the range of delivery duration inside the individual customer groups.

Table 8. Range of delivery durations inside an individual customer group.

Minutes / Hectolitre								
	Alko	Gas station	Hyper	Kiosk	Market	On-trade others	Super-market	Whole-sale
Low								
High								
Minutes / SKU								
Low								
High								

As seen from Table 8, a large range between delivery durations inside the individual customer groups appears mostly because of large deviation between customers' delivery sizes, and even between deliveries to individual customer.

The facts mentioned above are the biggest reason for the deviation between groups and the deviation inside the groups, but a variety and volumes of collected empties are as well making a difference. Figure 8 below is presenting the average duration of empties collection per SKU for each customer group.

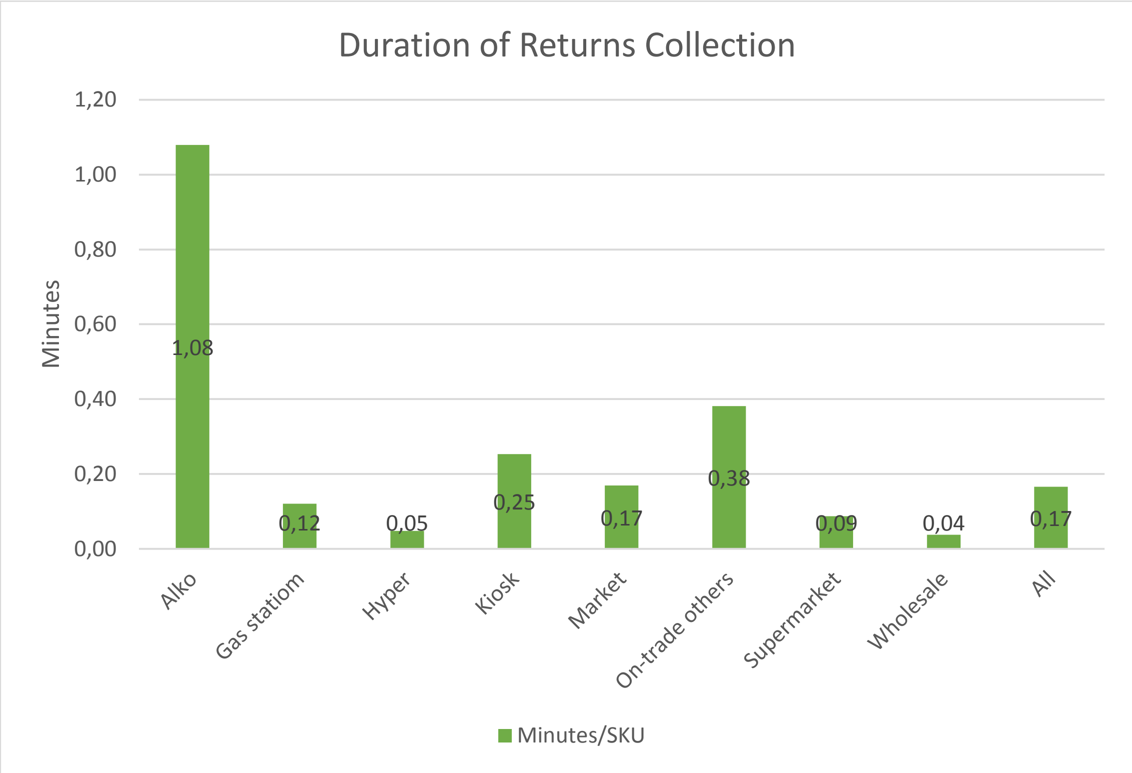

Figure 8. Delivery durations per SKU and per hectolitre.

As Figure 8 shows, there is lot of deviation between different groups. It takes over a minute to collect one SKU from Alko, but it takes only 0,04 minutes to collect it from a wholesale customer. Again, this is due the differences between the customer sites and the product variety. Most of the Alkos are returning only load carriers that were used in the delivery, whereas a wholesale customers are returning a lot of interlayers. The driver can collect over 200 interlayer on a single pallet, which significantly reduces the time used per SKU and makes the comparison to load carriers, etc. difficult.

3.3.4 Distribution Contractors' Cost Structure

Already at the first interviews an issue was raised regarding the driven kilometres since the current distribution pricing model's payment to the distribution contractors is too heavily based on driven kilometres. It was based on the assumption that for the contractors, the cost of driven kilometres are not as high as the weighting of that is on the current pricing model. Below, Table 9 presents the cost structure of the truck transportation companies in Finland.

Table 9.Cost structure of truck transport companies. (Tilastokeskus 2017)

	Vans and light trucks	Medium heavy and heavy trucks	truck & trailer combinations	All
Total index	100	100	100	100
Drivers' wages, fuel, tyres	49,9	47,6	53,2	51,8
Indirect labour costs, daily allowances and accom-modation	25,3	19,4	17,7	18,9
Repair & service, mainte-nance	6,6	6,6	8,2	7,7
Depreciation of capital, in-terest costs, insurance, transport charges, admin-istration	18,2	26,3	20,9	21,6

Table 9 shows that the drivers' wages, fuel and tyres make average of 52 percent of the total costs of truck transport companies. The deviation of these cost between three vehicle groups is only 3,3 percent points. Cost structure shown in Table 7, gives an average of all truck transport companies, operating in all fields in Finland. Although the numbers are not 100 % accurate for the case company, those can still be treated valid enough for the purpose of this study.

3.4 Summary of Key Findings

Based on the results of the current state analysis, the current distribution pricing model can be recognised as an activity-based costing model. As typical of an activity-based costing model, it is very detailed and based on actual transactions.

Based on the results of the interviews, strengths of the current model include the fact that it is encouraging contractors to work efficiently, it follows the volume fluctuation, it is cost efficient for the company and it is quite equal to all parties. Also, it is quick enough to use to calculate and form purchase invoices at the beginning of every month, so that the costs can be allocated to the correct month. It also simplifies the contract negotiations with the new contractors as it is standard model in company's distribution.

However, weaknesses of the current model relate to the fact that it is very complicated, it cannot fully capture the complexity of the activities and it lacks transparency. Also, it is not supporting competitive bidding, quality has no effect on it, it is not aligned with ERP-system, and it cannot be adjusted based on the costs of living in different parts of the country, or by delivery site.

Table 10 below summarizes the identified strengths and weaknesses of the current model.

Table 10. Strengths and weaknesses of the current distribution pricing model.

Strengths	Weaknesses
Cost efficient	Very complicated
Standard	Cannot fully capture the complexity of the activities
Quite equal	Lacks transparency
Follows volume fluctuation	Not supporting competitive bidding
Purchase invoices can be formed in a day	Quality not involved in the model
Encouraging to efficiency and full loads	Not aligned with the ERP-system
	Cannot be adjusted based on the area
	Cannot be adjusted based on the delivery site

As seen from Table 10, there are four main component in the current pricing model, which are partly used to encourage drivers and contractors to perform certain tasks. For example, the delivered volumes, customer stops and collected empties & full goods form 48% of the payment to the contractors. Therefore, the model encourages the drivers to deliver large volumes and collect empties, which both are also in the case company's interests. That is also why the current pricing model does not take into notice loading and unloading at the depot in any sense, even though they make one of the main task of distribution drivers. Loading and unloading are something what the drivers need to do anyway, and therefore the company has not seen it beneficial to include those to the pricing model.

Another invisible part of the current model is shelf replenishment. It is neither a very visible part of the current model, even though it is highly linked to the quality of the delivery. This can cause disadvantage for the company. The quality overall is not part of the current pricing model and it is not common to invoice goods broken in the transit, from the contractors.

The current driver fee calculation system is recognized as an old, complex and difficult to use. If the critical weaknesses are summarized, the current system uses its own master data that is not completely aligned with the company's current ERP-system. There is also only one employee in an external company who can make changes to the system, which is a clear business risk for the case company. These and other facts found from the current state analysis support the assumption that the company needs a new driver fee calculation system.

On the other hand, the drivers' worktime analysis also revealed large deviations in the delivery durations. Delivery duration varied heavily between different customer groups, and even between individual customers inside the groups. Similar phenomena was found also in the driving times. There may be a deviation of 25 percent points in the time used for driving between different vehicle groups. This is mostly due the fact that different vehicles types are used to deliver to different kind of distribution areas and customer sites. In the current pricing model, these deviations have been noticed in the payment by two different values in the customer stops and in the different unit price paid for driven Km's. It can be seen as another weakness that the current model does not take more accurately into notice the differences between the customer sites, which brings some inequality to different contractors.

The assumption when study started was that current distribution pricing model's 46 % weighting on driven kilometres is too large. In fact, it is actually little bit less than the average cost of driven kilometres is for the truck transportation companies in Finland. Nevertheless, it is still very difficult for the company to monitor that the drivers are reporting the driven kilometres correctly.

In a bigger picture, the company's current pricing model has worked very well for a long time. Nevertheless, several adjustments has been done because of the changes in the business environment and that has made the model even more complex than what it originally was. In addition, the system has come to the end of its lifecycle and needs to be replaced. As the current status of the distribution pricing is still quite good, both, the pricing model and the system can be used as a comparison on proposal development and validation.

4 Existing Knowledge on Pricing Models

For all companies, and especially for manufacturing companies that have a large products variety, it is essential to know the true costs of products and activities in their operations. For this purpose, several costing methods have been developed. These methods usually aim to make visible the cost of the activities performed by the businesses, so that the knowledge can then be used as a tool for decision making, improvements and development.

This section will present three methods that are relevant for this study, and which can be at least partly used when building a new distribution pricing model. This section will not discuss all the available methods, but will only focus on those that are relevant to the findings in the current state analysis, and to the study overall.

4.1 Activity-Based Costing

Since 1980's, many companies have started to use activity-based costing (ABC), to assign cost more precisely. In the ABC-model, the true costs of performed activities can be assigned to the products or customers. It differs from the traditional accounting methods in a sense that it assigns only the cost of activities that has been used, to the products or customers. This can be very valuable information for the companies, as usually all the products and customers are not causing similar amount of expenses.
(Pirttilä & Hautaniemi, 1994, p. 327; Harold, 2017)

According to Kaplan and Cooper (1997), ABC-model can provide answers to four questions. First, what activities are performed by the resources of the organization? Second, how much does it cost to perform those activities? Third, why does those activities need to be performed, and fourth, how much of the activities are needed for an individual product, service or customer? (Kaplan & Cooper, 1997, p. 79)

In activity-based costing process, the first step is to assign the costs of the resources to activities. In the second phase, the cost of the activities are assigned to the products or services, which used the activities. Figure 9 below presents this process in more practical way. (Pirttilä & Hautaniemi, 1994, p. 327; Harold, 2017)

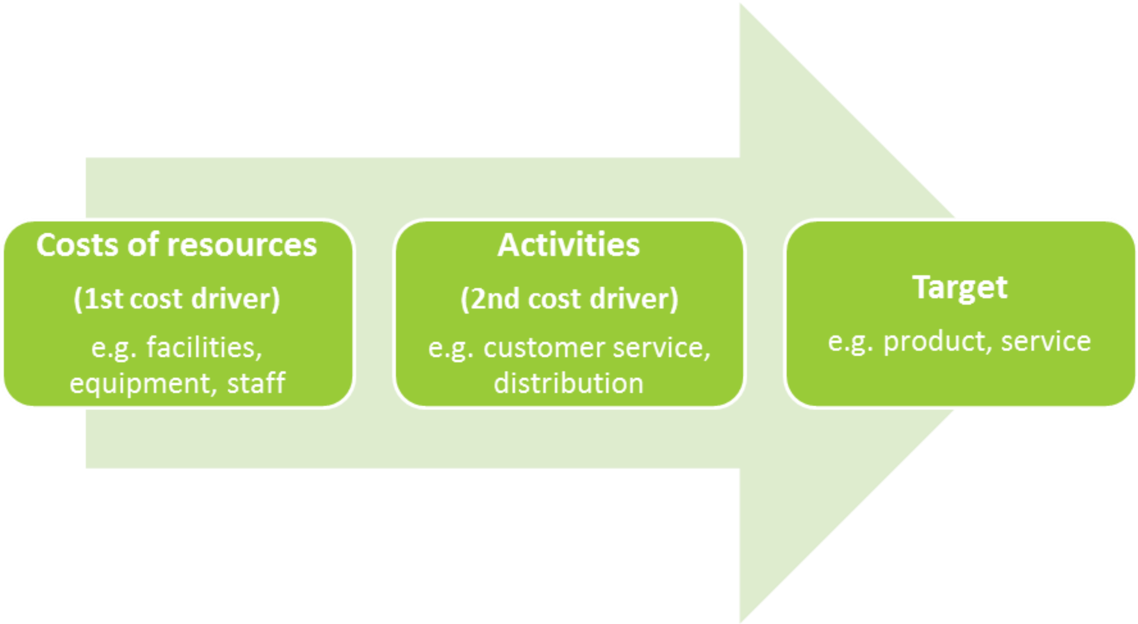

Figure 9. Process to assign costs of resources to activities and further to individual targets. (Pirttilä & Hautaniemi, 1994; Harold, 2017)

Before starting to use the ABC-model, company needs to define the purpose for using it. If it is for strategic decisions only, the data does not need to be as precise as is needed if it is used to control the activities. If costs of the products are known on a level detailed enough, those can be assigned to the customers or products to evaluate the profitability of them. (Pirttilä & Hautaniemi, 1994, p. 327) Table 11 below presents an example on how the costs are assigned to customers using the ABC-model.

In the example shown in Table 11, the same amount of same products are delivered to two different customers. The only difference is that customer A needs only five deliveries in a year, but customer B needs ten deliveries, even the total number of products is the same.

Table 11. Assigning costs to customers using activity-based costing. (Tilisanomat, 2017)

Overhead costs			
	Customer Service	**Picking**	**Distribution**
Resources persons	2 persons	3 persons	1 person
Frequency	2000 times / year	1750 times / year	880 times / year
Cost	120 000€ / year	180 000€ / year	60 000€ / year
Cost of an activity			
	Customer Service	**Picking**	**Distribution**
Cost of an activity = Costs / Frequency	60€	102,86€	68,18€
Cost of activities assigned to customers			
Customer A	**Customer Service**	**Picking**	**Distribution**
Frequency of the activity used	5 / year	5 / year	5 / year
Costs of the activity	300€	514,30€	340,90€
Total cost of the customer A	1155,20€ / year		
Customer B	**Customer Service**	**Picking**	**Distribution**
Frequency of the activity used	5 / year	10 / year	10 / year
Costs of the activity	300€	1028,60€	681,80€
Total cost of the customer B	2010,40€ / year		

In the example shown in Table 11, first the total cost of an activity is calculated based on the costs of resources and the total quantity of activities. Second, the cost of activities are assigned to the customers. Calculation reveals that delivering the same amount of products to customer B costs 2010,40€, when it costs only 1155,20€ to deliver those to customer A. (Tilisanomat, 2017)

ABC-model is easy to use in a simple processes as it can include several cost drivers for an activity. Nevertheless, if the company has a large variety of products and activities, the ABC-model also needs a large variety of cost drivers, which will make the model much more complex. Therefore, it is important that the ABC-system is integrated to company's other accounting systems to ease the update of costs. Complex activities that include a lot of different infrequent exceptions can be very difficult and expensive to include to the ABC-model. However, if the company wants to include those prices to the price of the products, it is necessary to know the true costs. (Pirttilä & Hautaniemi, 1994, p. 332)

4.2 Time-Driven Activity-Based Costing

In 2004, Kaplan and Anderson published a time-driven activity-based costing model. It is a newer version of the activity-based costing model (ABC), developed to fix many of the issues in the earlier model. Many organizations have abandoned the traditional ABC-model because it is difficult to implement and maintain, and because it cannot capture the complexity of large processes with many variables. (Kaplan & Anderson, 2004, pp. 131-133)

In the time-driven ABC-model, a company does not need to assign resource costs to activities, products or customers. It is enough that the demanded resources are assigned to activities. Therefore, only the *unit time of consumption* (time-driver) and the *cost / time unit* are needed. In the time-driven ABC-model, a single task can include multiple time-drivers to capture the complexity of the task. While in the ABC-model, only one cost driver can be assigned to individual task, and costs are more based on average values of larger entities. (Everaert & al., 2008, pp. 187-188; Kaplan & Anderson, 2004, p. 133)

The *cost / time unit* can be calculated based on the costs allocated to the function, department, etc. and the time used. When calculating the available time of the resources, it should be noticed that even the worktime of an employee is 40 hours in a week, the productive work time is usually not. After reducing the arrival & departure, breaks, trainings, and communication, the productive worktime can be around 80% to 85% of the total worktime. Therefore, it is the productive worktime that should be used to calculate the cost / time unit. (Kaplan & Anderson, 2004, pp. 133-134)

For example, if departments costs are 10 000€ per week and the productive time of 10 employees is 32 hours per week, the *cost / time unit* is 10 000€ / 19 20 minutes = 5,2€ / minute. In practice, it means that every used minute to a certain task costs 5,2€ for the company. (Kaplan & Anderson, 2004, pp. 133-134)

The *unit time of consumption* to a certain task should be either measured or estimated.

But it is important to understand that the value does not need to be 100% exact, it is precise enough if it hits 5-10% range. (Kaplan & Anderson, 2004, p. 133)

With the *cost / time unit* and *the unit time of consumption*, it can be calculated how expensive it is to perform a certain task. To take a practical example, let's think about entering a new order to the company's system. If it takes ten minutes to enter an order and *cost / time unit* is 5,2€, entering one order costs 52€ for the company. (Kaplan & Anderson, 2004, pp. 133-134)

In many cases, there are multiple variables for each activity. For example, it can take 10 minutes to enter an order for an existing customer, but 15 minutes extra is needed in case of a new customer. Table 12 below presents an example where the estimated time per order is 10 minutes, but an additional 15 minutes is added because it is for a new customer. (Everaert & Bruggeman, 2007, pp. 16-17)

Table 12. Six steps to illustrate the time-driven approach. (Everaert & Bruggeman, 2007, pp. 16-17)

Step	Definition	Description	Value
1.	Resource groups	Identify the resource groups that perform activities	One resource group including 10 sales personnel
2.	Costs of the resource groups	Estimate the cost of each resource group	10 000€ / week (Wages, ICT)
3.	Practical capacity	Estimate the practical capacity of each resource group	80% practical capacity, as 20% is going to arrival & departure, breaks, trainings, and communication
4.	Cost / time unit	Calculate the unit cost of each resource group by dividing the total cost of the group by the practical capacity	10 000€ / (40*0,80*60 min) = 5,2€/min
5.	Unit time of consumption	Determine the required time for each event of an activity, based on the time-drivers	$t_{\text{given order}}$ =10min + 15min $_{\text{if new customer}}$ e.g. order processing for a new customer = 25 minutes
6.	Total costs	Multiply the unit cost and the time required	5,2€/min * 25min = 130€

While there are many studies that are claiming the usefulness of the time-driven model, some are more sceptical. In a study from 2016, Professor Namazi has highlighted a few main weaknesses of the time-driven model. These arguments are based on his research on earlier studies for the time-driven model. Key findings from the weaknesses that are related to this study are listed on Table 13 below. (Namazi, 2016, pp. 457-482)

Table 13. Key weaknesses of the time-driven activity-based costing model (Namazi, 2016, pp. 457-482)

Weakness	Detailed Description
Activity identifying	Lack of ability to identify activities in the first implementation step. E.g. practical capacity cost rate, uniform capacity cost rate, time estimations, unused capacity determination, data accuracy and managerial decision making
Cost drivers	Model is applicable only if time is the only needed cost driver
Complex activity identification	Activities need to be identified distinctly to avoid using the same values for whole department, as done in the ABC-model
Deployment	For deployment to a department that performs more than one activity, some kind of a survey is needed
Model creation	In some cases, model may require as much data collection as does the ABC-model
Time estimations	Estimations are not precise data and can lead to a faults

As a conclusion, it can be said that the time-driven ABC-model is not only simplified, but also easier to update than the previous model. If the company changes its processes and that effects the duration of the calculated task, *unit time of consumption* can be adjusted to match the new process. If the cost of the resource changes, only the *cost / time unit* needs to be adjusted. (Kaplan & Anderson, 2004, p. 134)

The previous ABC-model relied in the assumption that all particular events and transactions are similar and consume the same amount of time. The time-driven-ABC is more flexible on this. It can capture the complexity and variation of the practical events by integrated time equations, and at the same time, achieve a more precise result. In the case study of a wholesaler's logistics activities, Everaert et al. (2008) revealed that where ABC-model were capable of capturing only one single cost per task, the time-driven ABC captured also the costs of several possible sub tasks. This case study also showed that, a more precise cost allocation led to a higher level of transparency on customer profitability and helped to enhance the current processes. (Everaert & al., 2008, p. 189; Kaplan & Anderson, 2004, pp. 134-138)

Time-driven ABC also reveals the used capacity of the resources. As the company needs to define the available productive time of its resources, and the times that are needed to operative tasks, it highlights also the resource utilization rate. (Everaert & al., 2008, p. 189; Kaplan & Anderson, 2004, pp. 134-138)

Nevertheless, there are also some weaknesses and they need to be recognized. Regarding the findings on Namazi's study on the time-driven model, some of the weaknesses are similar to the traditional ABC-model, and in some cases it can be just as complex as the traditional ABC-model is. Namazi's study also criticizes the managerial involvement that is needed to update the model and the inaccuracy of the time estimations needed to update the model. (Namazi, 2016, pp. 457-482)

4.3 Performance-Based Logistics

Performance-Based Logistics (PBL) is a new and creative approach to logistics procurement. It is an invention that US Department of Defence (DoD) started to use in the late 1990's. PBL contract differs from traditional transaction-based contract in the way that customer is paying for the results, not by the quantity of transactions. Often, the issue with transactional based contracts, is that more the service provider is producing, the more it gets payed. Therefore, the contract is not supporting the service provider to deliver quality and best possible output for the customer, but instead as many transactions as possible. In PBL-contract, the customer and the service provider mutually agrees on the desired output(s) and the service provider can then decide how to achieve that target. In practice, this can mean that the customer is not paying for the quantity of spare parts warehoused or maintenances done, but from the machine hours operated without malfunctions, as a percentage of maximum operating hours. (Vitasek, Kate; Geary, Steve, 2007, pp. 1-3; Vitasek & Geary, 2008, pp. 62-63)

Figure 10 below presents the operating model of PBL. In PBL-model, a supplier is normally responsible for delivering, not only the product, but also the support services, such as repair and maintenance. Customer is only paying for the desired output, which in this case is the agreed level of operating hours, instead of the transactions performed by the service provider.

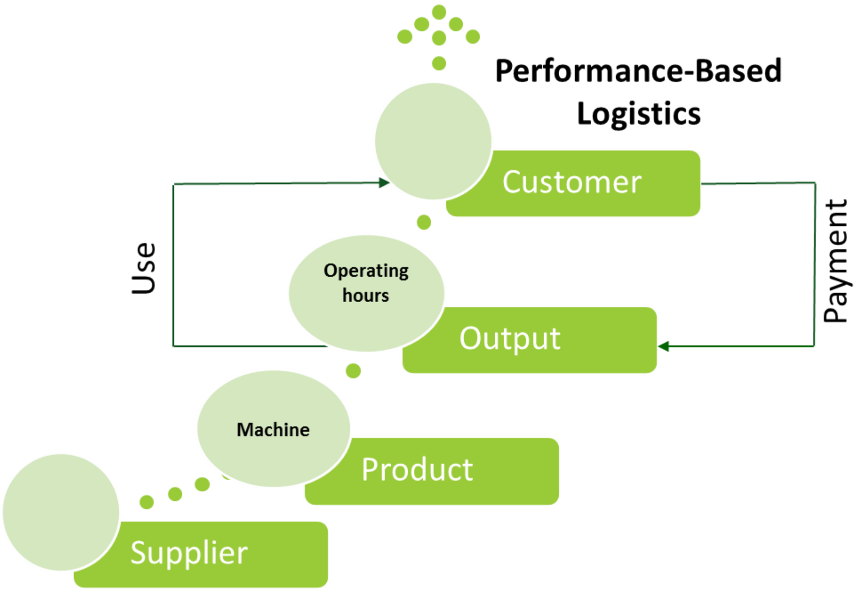

Figure 10. Operating model in Performance-Based Logistics. (Holmbom, Bergquist, & Vanhatalo, 2014)

When delivery of the product and the support services are integrated into one package, the service provider has a possibility to improve its operations to support the desired outcome and to reduce costs. The PBL-contract usually includes also incentives, which are paid if the service provider manages to achieve the outcome agreed in the contract. (Vitasek, Kate; Geary, Steve, 2007, pp. 1-2) Figure 11 presents the similar case as in Figure 10, but with the traditional operating model.

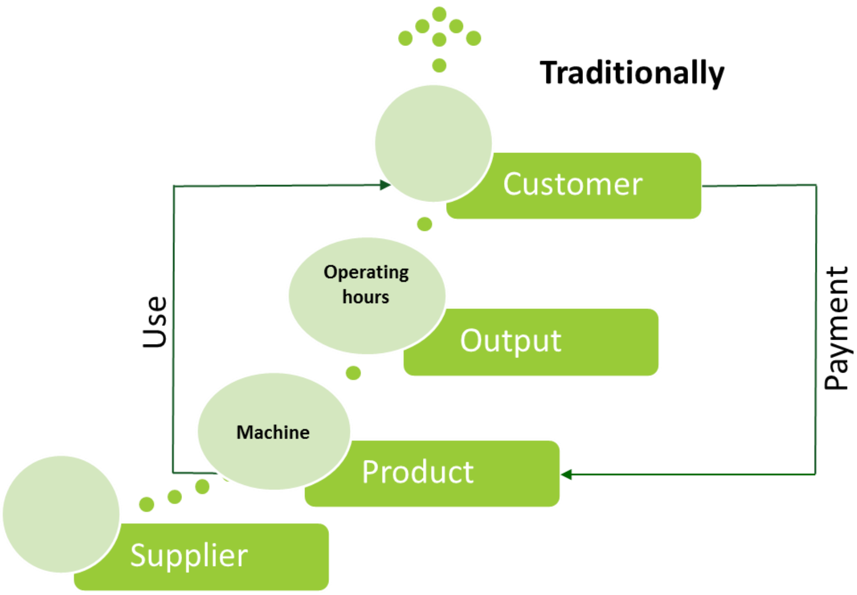

Figure 11. Traditional operating model. (Holmbom, Bergquist, & Vanhatalo, 2014)

In the traditional model, the customer is paying from the agreed transactions, even those are not necessarily leading to the desired outcome. To achieve the desired target, it is important that both parties are collaborating and agree on the contract terms. The PBL-contract should be financially beneficial for both parties. Vitasek and Geary have pointed four key subject for successful PBL-contract.

First, both parties need to be committed for collaboration and understand that the agreement is truly a shift in the business-model. The goal is a mutual beneficial operation model, not the cheapest possible cost per transaction.

Second, the client and the service provider need to define the desired outcome in co-operation and so that that the outcome is measurable. *Third*, the parties need to develop a robust contract, that includes the pricing structure and incentives that support the operations to achieve the desired outcome. This kind of a fixed price contract is useful when buying a performance output, because service provider’s only possibility to gain larger profits is to increase efficiency. If the volumes are fluctuating a lot, also volume bands can be added to allow the pricing to follow the fluctuation.

Fourth, the PBL-contract needs to include a performance management program. Contract should include five or less performance metrics that clearly defines who is measuring what and when. Performance metrics should also be reported and reviewed regularly. In the end, it is service provider’s responsibility to ensure the quality of performed activities and customer’s responsibility to monitor those activities.

As a conclusion, the PBL-contract should include the desired outcome and the metrics how the performance is measured. The client should not tell how that target is achieved, as that is something what service provider needs to figure out. (Vitasek, Kate; Geary, Steve, 2007, pp. 1-7)

As PBL-contract usually includes incentives, it can also include penalties. For this purpose there has been developed a model, where upper and lower limit of normal performance are defined based on a historical data. In Figure 12, the area of normal performance is called a dead zone. Anything above normal is in the reward zone and anything under it, is in the penalty zone. (Sols, Nowic, & Dinesh, 2007, pp. 44-45)

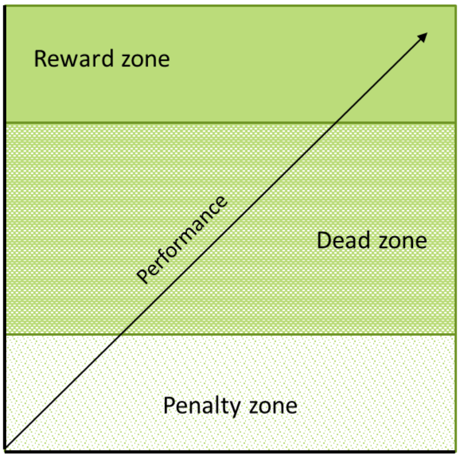

Figure 12. Concept of reward-, dead- and penalty zones for PBL-contract's incentives. (Sols, Nowic, & Dinesh, 2007)

Limits of reward- dead- and penalty zones, shown in Figure 12, can be revaluated after new data on the performance is collected. The purpose of the different zones is to ensure a win-win situation for the parties, where service supplier is rewarded for achieving the desired target and customer gets a result from what it payed for. If the contract is well done and operations correctly managed, this should lead also to reduce costs of both parties. (Sols, Nowic, & Dinesh, 2007, p. 44; Vitasek, Kate; Geary, Steve, 2007, pp. 1-10)

4.4 Conceptual Frame Work for Distribution Pricing Model

To create a guidance for proposal building, four key findings (revealed from the current state analysis) directed the search for relevant ideas from existing knowledge. In this section, the identified most relevant best practice related to the pricing models are combined into the conceptual frame work.

Figure 13 below presents the conceptual framework of this study.

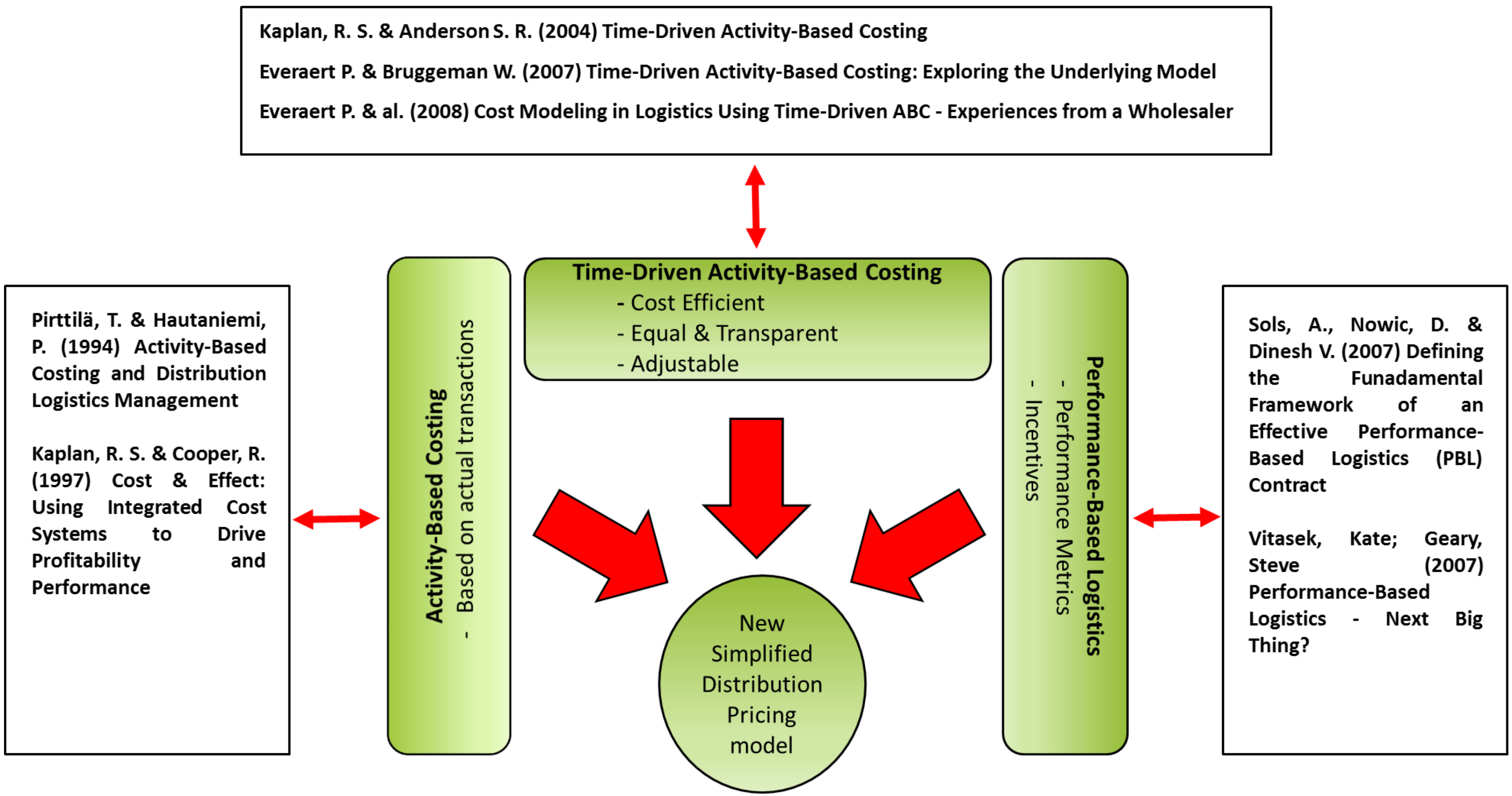

Figure 13. Conceptual framework of the study.

As seen in Figure 13, in the conceptual framework, the most important strengths and weaknesses of the current pricing model (revealed from the current state analysis) have guided the search for the features for the new model, so that to address them. These most important strengths and weaknesses are combined to smaller groups, and placed under one of the three pricing models, to remind about the practical challenges behind the search for ideas from literature.

The first type of the examined pricing models is the *activity-based costing*, also known as *ABC-model*. Since 1980's it has been successfully used in numerous organizations worldwide, including the case company. The downside of the *ABC-model* is that, if a company wants to capture complex activities on a detailed level, the model will also become very complex and lose its transparency.

The second type of the examined pricing models, is the enhanced version of *ABC-model*, the *time-driven activity-based costing* (*TDABC-model*). It was developed to fix some of the issues with the *ABC-model* and it can more easily capture the complexity of the activities, without totally losing the transparency.

The last type among the examined models is the so-called *performance-based logistics*, which so far has been used mostly in the military organizations. It is designed to support large scale logistics processes performed by external service providers. It is based on the principle that the customer pays from the desired output, not by the actual quantity of transactions performed.

Performance-based logistics model encourages the service provider to improve its processes, which should lead to a better service level with reduced total costs.

Neither one of the three pricing models are necessarily usable for the case company by themselves, but the new model can be built by combining the relevant parts of all three to the case company specific model, in Section 5.

5 Building Proposal of the Distribution Pricing Model for the Case Company

This section presents the proposal building for new distribution pricing model and discusses what it is based on. The goal for this section is to present all parts of the new model, as well as to demonstrate how these parts combined together and how the outcome of a simplified pricing model can be reached.

5.1 Overview of Proposal Building Stage

At the first phase of the proposal building, the findings from the current state analysis and existing knowledge on the pricing models were presented to the key stakeholders. Based on their feedback, the proposal building for new model was started.

The results of the current state analysis confirmed that company's current pricing model is very complicated, but it also revealed that so is the environment where it is operating. Therefore, it was recognized as a great challenge for the pricing model to be able to capture the complexity of the operations, without losing the transparency and equality. To achieve this goal, it became clear that none of the existing models is appropriate for the company by itself, but the new model needs to be tailor-made.

Therefore, next the proposal building focused on combining the parts of the three models identified earlier in Section 4, into a one that should suit for the case company. Moreover, the proposed new model should address certain specific requirements of the case company. First of all, as highlighted in the objective and desired outcome of this study, as well as in the feedback to the current state results, the new model should be simplified and transparent, without losing the cost efficiency. It should also be more equal to the distribution contractors than the current model is.

The only limitation set for the model is that its core should be based on the same parameters that are used in the case company's ERP-system. This is due the fact that by optimizing its route planning, the company should benefit also in the costs of distribution.

How those three models were combined and used in the proposal is presented below, with each element of the new model discussed in their own subsections, and in the end combined together into a proposal draft.

5.2 Fixed Costs

The proposed model is using six vehicle classes that are used in the company's route planning, as these are also supporting the pricing model to capture the differences between vehicle sizes. Vehicle classes, euro per kilometre prices and euro per hour prices that are used in the proposal are presented below in Table 14.

Table 14. Vehicle classes used in route planning.

Vehicle classes used in route planning	Description	€/Km	€/h
MRC	Small van	0,26	19
Van	Big van	0,3	20
Small truck	Two axel truck	0,8	22
Truck	Three axel truck	0,9	22
Big truck	Truck for truck & trailer combination	0,95	23
Trailer		N/A	23

As seen in Table 14, the price per kilometre depends on the size of the vehicle and is higher for the larger vehicles than for the small ones. Price per kilometre is based on two things. First, larger vehicles have larger costs for the contractors. Second, different size vehicles operate in different areas, like in city centre or in rural area.

The cost per kilometre shown in Table 14 is based on the cost of the vehicle, whereas the cost per hour is based on the cost of the driver. Price per hour is following the same logic that is used with the kilometres, drivers operating larger vehicles have higher price per hour. That is also the logic on the drivers' salary, as larger vehicles usually have more educated drivers than the smaller ones.

Taken together, the two factors shown in Table 14 are presenting the fixed costs of the pricing model. The fixed cost are used together with the driving time and kilometres to calculate the price that is paid from driving. Total price of kilometres can be calculated based on planned kilometres or actual kilometres driven in a period of time. Planned kilometres are the preferred one, as this will decrease the need for reporting and monitoring. However, to be able to use the planned kilometres as one of the basis for distribution pricing, the company needs to ensure that drivers are adhering to the planned route and the route planning quality is good enough. This is an exercise that the company needs to perform, before the planned kilometres can be used to calculate the payment to the contractors. This will also increase the level of route planning optimization and therefore benefit the company in a long term.

5.3 Time-Drivers

Time-drivers are needed to calculate the time used to different activities, which then can be multiplied with the cost per hour rate in Table 14. The sum of this equation is the total cost of the time used to the activities. The proposed model needs the time-drivers for loading and unloading times, the delivery times, collection of empties and for the use of hand held terminal. Shelf replenishment is excluded from this study as measurements were mostly done in an area were drivers are not doing shelf replenishment. The case company have also other ongoing project on shelf replenishment and data from there can be later used to establish time-drivers for shelf replenishment, if needed.

To create time-drivers, the data from worktime measurement was combined with the volumes retrieved from the company's ERP-system. This comparison highlighted the differences in the delivery times to different customer sites and with different volumes. For customer sites, similar customer groups were used as in the current state analysis Table 7. In addition to the customer groups, also the delivered goods and collected empties were divided into groups between different product types, and volume bands were defined to all product groups. Based on the customer group, the product type and volume bands, there was defined a time per SKU, which can be used to calculate the delivery time. When the product and volume is known, the time of delivery can be calculated using the time defined for the product.

Table 15 presents the defined time-drivers when delivering the trays, kegs or similar SKU's to the customers.

Table 15. Time matrix for delivering trays, kegs or similar SKU's.

	Volume bands			
Customer Group	**1-2 SKU's**	**3-10 SKU's**	**11-30 SKU's**	**>30 SKU's**
Wholesale	1,2 min	0,5 min	0,2 min	0,1 min
Alko	1,5 min	0,6 min	0,2 min	0,1 min
Hyper	1,2 min	0,5 min	0,2 min	0,1 min
Supermarket	1,2 min	0,5 min	0,2 min	0,1 min
Market	1,1 min	0,6 min	0,3 min	0,2 min
Gas station	1,4 min	0,5 min	0,3 min	0,3 min
On-trade others	1,2 min	0,8 min	0,6 min	0,5 min
Kiosk	1,2 min	0,8 min	0,5 min	0,4 min

As seen from Table 15, the time-drivers vary depending on the volume and customer group. For example, if there is a delivery of 10 crates, it takes 0,6 minutes per SKU to deliver it to a market, but 0,5 minutes per SKU to deliver it to a gas station.

In most cases, the drivers also collect the returning empties during the same visit when they are delivering full goods. Table 16 presents the time-drivers and volume bands per customer group for collected empty kegs and gas bottles.

Table 16. Time matrix for collected empty kegs and gas bottles.

	Volume bands		
Customer Group	**1-8 SKU's**	**9-16 SKU's**	**>16 SKU's**
Wholesale	0,1 min	0,1 min	0,1 min
Alko	0,5 min	0,3 min	0,4 min
Hyper	0,5 min	0,3 min	0,4 min
Supermarket	0,5 min	0,3 min	0,4 min
Market	0,5 min	0,3 min	0,4 min
Gas statiom	0,5 min	0,3 min	0,4 min
On-trade others	0,5 min	0,3 min	0,4 min
Kiosk	0,5 min	0,3 min	0,4 min

According to the worktime measurement, additional 1,75 minutes is needed to insert the adjustments on delivered quantities and collected empties, to the driver's HHT. Therefore, the total delivery time for a customer makes the sum from the delivery of full goods, collected empties and HHT use. For example, if a driver delivers 10 crates to a customer that belongs to on-trade others group and collects 10 empty kegs, the total delivery time is 8 minutes for full goods delivery + 3 minutes for collected empties + 1,75 minutes for HHT use = 12,75 minutes.

Above is a simplified example on how the model is used to calculate the delivery time to the customers. In addition to the driving and delivery times, the drivers are daily loading and unloading their trucks at the cross docks. Loading and unloading times vary between different vehicle groups and are partly dependent on the volumes. However, as the variation keep on an acceptable level, there can be used a fixed time-driver per vehicle class. These time-drivers can be found from Table 17 below.

Table 17. Time-drivers for loading and unloading.

Vehicle class	Loading at the Cross Dock (min)	Unloading at the Cross Dock (min)
MRC	30	11
Van	50	14
Small truck	75	15
Truck	77	16
Big truck	60	10
Trailer	N/A	N/A

In the worktime measurement also all breaks and waiting time where measured. With a fixed percentage, those will act as the last one of the time-drivers. When comparing measured waiting and break times to the total productive working time, the average of seven percent of the working time is going to the waiting and breaks. In practice this means that the total working time needs to be multiplied with 1.07 to include the breaks and waiting time. This Mentioned factor includes only very short waiting times, all the exceptional waiting times are excluded. Therefore, all the exceptional waiting times need to be handled separately and added to the total price paid to the contractor. This is already a normal process for the case company and the drivers operating in its distribution. In case some exceptional waiting time appears, the driver needs to contact the distribution supervisor to get a confirmation for the waiting time, which is later added to the payment for the contractor.

Waiting times and break times can also be included to the delivery time-drivers to simplify the model. This is not done in this study because it is still an open question if the company wants to develop its route planning system towards the proposed pricing model. This would mean that the route planning system would use a similar calculation for the delivery times to the customer sites. If so, including the break and waiting times to the delivery times would affect the delivery time calculation in route planning and therefore also affect the route planning quality.

5.4 Incentives and Penalties

Quality should be part of the pricing model in the sense that good quality is rewarded and bad quality will lead to penalties. This way the incentives can be used to encourage the drivers to deliver good quality. The proposal is that the concept of reward-, dead- and penalty zones presented in Section 4.3 should be modified for the case company and included into the pricing model.

First, the proposal is to use a fixed penalty in a case where a vehicle is not available for the case company's use during all business days. In such a case, there should be a fixed penalty per day, which is deducted from the total payment. Proposal for the penalty is 50 euros for the vehicles in MRC and van classes, 75 euros for small trucks and trucks and 100 euros for big trucks. Split-level penalty is designed to follow the average turnover of different vehicle groups.

Non-fixed incentives and penalties should be based on two factors: on-time deliveries and item line adjustments. As both are already measured by the case company, those just needs to be included into the proposed new pricing model.

On-time deliveries mean, that the case company is measuring how well the drivers are hitting the agreed customer time windows. Company's ERP-system is already collecting the delivery times, which are based on the time when driver marked the delivery finalized in the HHT.

Item line adjustments are followed up by the route settlement department. Route settlement department is collecting data from the item line adjustments that are done after the driver has finalized the delivery in the HHT. This means that either the customer or the driver is afterwards informing the route settlement department about a mistake done by the driver while processing the delivery in the HHT.

The company's distribution department should include on-time deliveries and item line adjustments into the pricing model so that currently 10 percent of the drivers hits the penalty zone, 85 percent hits the dead zone and 5 percent hits the reward zone. This would encourage 95 percent of the drivers to improve their performance and would lead to improved quality for the company.

Proposal for the penalty and incentive is 5 percent from the total turnover of the vehicle. For example, for a vehicle that has 5000€ turnover in a month, it would in best case mean 3000€ incentive and in the worst case a 3000€ penalty in a year. As the company has agreed to monthly payments for the contractors, also the incentives and penalties should be calculated monthly.

5.5 Proposal Draft for the New Distribution Pricing Model

In this subsection a draft of the proposal is presented. It is based on the simplified examples presented earlier in the subsections of section five. The following Figure 14 outlines the structure of the proposed new pricing model.

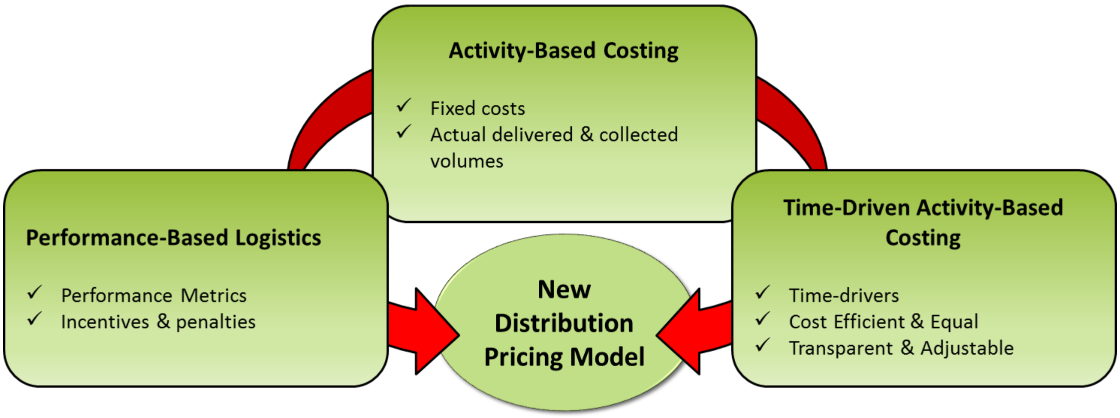

Figure 14. Structure of the proposed pricing model.

As presented in Figure 18, the proposal is very much based on the best practice of three pricing models studied in the literature review. The proposal combines parts of all three to one model that is tailor made for the case company.

Next, Table 18 presents the fixed costs of the proposed model. It includes vehicle classes, kilometre prices, drivers' hourly rates, fixed loading and unloading times and factor for break and waiting time.

Table 18. Fixed prices for kilometres and hourly rate, fixed time-drivers for loading and unloading, and factors for break and waiting time.

	Driving		Fixed Loading / unloading time		Breaks and waiting
LEO Vehicle Classes	**€/Km**	**€/H**	**Loading at the Cross dock (min)**	**Unloading at the Cross Dock (min)**	**Factor for breaks & waiting**
MRC					
VAN					
SMALLTRUCK					
TRUCK					
BIGTRUCK					
Trailer					

Second, Table 19 on the next page presents the matrix for delivery times per SKU, time for empties collection per SKU and the fixed time for HHT use per customer visit.

Table 19. Proposed matrix for delivery times, collected empties and HHT use.

	Delivered Full Goods											
	Tray, crate, keg, etc.				Dolly					Full Pallet		
Volume band	1-2	3-10	11-30	>30	1-2	3-4	5-12	13-20	>20	1-2	3-5	>5
Customer Group												
Wholesale												
Alko												
Hyper												
Supermarket												
Market												
Gas station												
On-trade others												
Kiosk												

	Collected Empties											HHT use
	Palpa box,sack		Palpa container		Load carriers	Load carriers	Kegs, Gas Bottles	Kegs, Gas Bottles	Kegs, Gas Bottles	Crates, Trays, etc.	Crates, Trays, etc.	
Volume band	1-2	>2	1-2	>2	1-10	>10	1-8	9-16	>16	1-20	>20	
Customer Group												
Wholesale												
Alko												
Hyper												
Supermarket												
Market												
Gas station												
On-trade others												
Kiosk												

For penalties and incentives it is proposed to establish a follow up table with three columns per driver. In the first column, there is a number of item line adjustments done after the original delivery, in the second column, there is a percentage of deliveries done in the customer time windows and in the third column, a quantity of days the vehicle and driver has not been available for the company's distribution. All three figures should be followed up on a monthly basis.

Table 20. Sum of item line adjustments per month, percentage of deliveries done in customer time windows (on-time delivery), and days not available for the company's distribution.

Driver	Sum of item line adjustments	On-time delivery %	Days not available
302956	5	99,3	0
303737	17	98,5	0
303776	3	97,4	0
305244	2	99,8	2
307887	5	98,9	0
308839	1	99,0	0
308874	9	96,7	0
309334	4	99,1	1
313769	7	98,6	0
314904	0	95,0	7

Table 20 presents a simple way to collect and report the data that can be used to calculate the incentives and penalties.

Item line adjustments and on-time deliveries should have an effect of plus-minus 5 percent to the total payment for the contractor, and days not available as a fixed penalty based on vehicle class.

In the next section this proposal is validated, based on the key stakeholders' feedback and testing.

6 Validation of the Proposal for New Distribution Pricing Model

In this section the proposal is evaluated against the company's current pricing model and measured times, and base on the results, validated by the key stakeholders. The results of the validation and the evaluation feedback are discussed below.

6.1 Overview of Validation Phase

The initial proposal was presented to the key stakeholders in a one-to-one discussions. Worktime measurement conducted for Data 1, in the current state analysis, provided comprehensive data for the validation, as these measurements measured the durations of the working days and also the durations that drivers used to perform individual tasks. As the used time and the payment regarding the tasks done are known, it was possible to calculate an hourly rate for individual tasks and also for the total working time, when the current pricing model is used.

For proposed new model the hourly rates in Section 6, were calculated by using the fixed values from Table 19, the time-drivers from Table 20, and the actual volumes of shipments that were part of the work time measurement.

As the results of this demonstration and analysis of the results in the validation session, the key stakeholders were satisfied with the proposal, but stated that the model needs to be tested and compared to the existing pricing model, before any further steps towards implementation can be taken.

However, it needs to be emphasized that, within this study, it is not possible to do the full testing for all the measured shipments. Instead, the proposal was fully tested with five shipments and those were validated against the current distribution pricing model. The only exceptions to the validation were the penalties and incentives, which are totally new feature for the company, and therefore cannot be compared to the current pricing model.

In the next subsections, the hourly rates of the current pricing model are compared against the hourly rates of the proposed new model. In addition, the measured times were used to validate the correctness of calculated times in the new model, which would directly affect the total payment when the proposed pricing model is used.

6.2 Validation of the Proposed Pricing Model

This subsection is divided into four smaller subsections. In the first one, the cost of driven kilometres are compared against the current pricing model. Second subsection compares the cost of deliveries between the old and the new models, and the third subsection contains the comparison of total costs between the current and the proposed pricing models. This section ends with a summary of the final proposal for the new distribution pricing model.

6.2.1 Cost of Driven Kilometres

Already when building the proposal, the costs on driven kilometres in the current model were transformed to an hourly rate and compared to the proposed new model. Table 21 below presents the variation on the cost of driving between these models. To calculate the euro per hour prices, the measured driving times and the driven kilometres reported by the drivers were used. Comparison in Table 21 includes all shipments that were part of the worktime measurement.

Table 21. Costs of driving compared between the current pricing model and the proposal.

	Variation on the cost of driving (€/hour)	
Vehicle classes used in route planning	**Current pricing model's cost per driven hour**	**Proposed pricing model's cost per driven hour**
MRC	22-84	28-56
Van	27-49	28-37
Small truck	39-126	35-81
Truck	27-113	49-84
Big truck	62-110	58-77

As seen in Table 21, the proposed pricing model would decrease the variation of the cost that is paid from the driving, and increases the equality between the routes where the drivers are operating. The variation that is left is more natural as the cost of the driving also varies depending on the area. For example, in the city centre a driver can use one hour to drive twenty kilometres, whereas on a freeway 80 kilometres can be driven in the same time. Since driving one hour on a freeway consumes more, also the price per hour is higher for the contractor. This is replicated in the proposed pricing model and can be seen as a variation in the table.

6.2.2 Cost of the Deliveries

Using the same logic as in the previous subsection, it was possible to calculate also the cost per hour for the deliveries. For example, one driver using a *small truck (*vehicle category) had five working days measured during the study. Cost of the deliveries done during those days was compared between the current and the proposed model in Table 22. The comparison includes all activities related to the customer deliveries. In practise this means delivery of the goods, collection of the empties, HHT use and possible other activities done during the delivery.

Table 22. Cost per hour of the customer delivery compared between the current pricing model and the proposed new model.

Measured time	Calcu-lated time	Costs with current model	Costs with proposed model	Current model's cost per hour	Proposed model's cost per hour
14,64 h	14,73 h	425€	324€	29 €/h	22 €/h

As shown in Table 22, the total measured delivery time and the total calculated delivery time of all five shipments are close to equal. It should still be noted that there can be larger variations between the actual and the calculated delivery times in individual customer deliveries.

If the proposed new model was used, the cost of deliveries would have *decreased* from 29 euros to 22 euros per hour, compared to the current model.

As the company might prefer that the drivers collect certain empty products as much as possible and only a limited amount of other products, it needs to decided if an additional incentive is needed to support this scheme. In case needed, this can be done easily by adjusting the time-drivers of the product groups. But it needs to be noted that it will then increase the total calculated time and make a possible comparison to the actual times difficult.

6.2.3 Differences in the Costs Between the Current and Proposed New Pricing Model

When comparing the cost of the same five shipments used in Section 6.2.2 the differences can be seen between the current and the proposed pricing models. Next, Figure

15 presents the Scaling of costs for the test shipments when the current pricing model is used.

Figure 15. The current model´s scaling of costs for the test shipments.

With the current pricing model, XX percent of the payment to the contractor from the test shipments is coming from the driven kilometres. As Figure 16 shows, with the proposed new model, only XX % of the payment would come from the driving time and kilometres.

Figure 16. The proposed model's scaling of costs for the test shipments.

With the proposed pricing model, the total cost for the five test shipments would be two percentage lower than with the current pricing model. Again, the total cost can be adjusted, one way or another, by changing the time-drivers or the fixed price per hour.

6.3 Summary of Final Proposal for Distribution Pricing Model

As the key stakeholders were satisfied with the initial proposal, there were only very small adjustments done before the final proposal. However, before presenting the final proposal, the initial proposal was validated and compared to the current pricing model. Validation was done by transforming the costs to hourly rates and comparing the proposed pricing model to the current one. Validation revealed that in the proposed model, the variation on *the cost of driving* were much more moderate, which can be seen as increased equality between different routes. At the same time, when the variation decreased, also *the costs on driving decreased*. With the new model, costs of driving are closer to the actual costs that driving is causing to the contractors. Validation also showed that proposed new model can capture the complexity of the activities and the total used time in an adequate level.

The limited scale of testing should still be recognized as a limitation to making further conclusions, and a full scale testing is recommended, if the decision is to implement the proposed pricing model to the company’s operations. The full scale testing can be done after the system is developed, or already earlier by building the calculations to Microsoft Excel or similar program.

7 Conclusions

The seventh and last section of the study starts with an executive summary, continues to next steps and recommendations toward implementation of the proposal, and ends up to thesis evaluation and closing words.

7.1 Executive Summary

The objective of this thesis was to develop a new distribution pricing model for the case company. The need for this emerged in the case company as distribution is one of biggest cost of its logistic activities and the current model is coming to end of its lifecycle.

The study started with an introduction to the business challenge, objective and outcome, and continued to the overview of methods and materials. Next, the current state of the case company was analyzed. In the current state analysis, the main focus was placed on the company's distribution activities, and especially on the current distribution pricing model. The current state analysis provided a practical understanding of the business challenge at hand and gave a solid background for literature review at the next stage.

In the literature review, existing knowledge and best practice on the pricing models were investigated, and the three best fit approaches were selected and formed the conceptual framework of the study. Conceptual framework was then used as a tool to build an initial proposal for the new distribution pricing model. The new distribution pricing model was based on three key areas, first, *activity-based costing* model, second, the *time-driven activity-based costing* model, and third, *performance-based logistics*. The initial proposal was based on the elements taken from all three models, which were then combined together to a company specific pricing model. This initially built model was later validated and developed into the final proposal for the new distribution pricing model.

The new distribution pricing model proposed in this study includes the following key features. First, the fixed kilometre price, the hourly rates and the actual volumes were taken from the *activity-based costing* model. Second, the time-drivers were adopted from the *time-driven activity-based costing* model. Third, quality were integrated to the model based on the learnings on *performance-based logistics* model.

The proposal for the new distribution pricing model is therefore based on the time that is used on the activities. However, the time is *calculated* based on the planned driving time, actual delivered volumes, and the product-, customer-, and vehicle groups. Therefore, the pricing can be considered as a fixed, which dramatically reduces the need of monitoring and supervision, if compared to the pricing that is based on the actual used time.

The quality aspect of the proposal is based on three key performance indicators (a) Item line adjustments, (b) on-time deliveries and (c) the days not available for the company's use. For the item line adjustments and on time deliveries, it is proposed to have a plus-minus 5 percent intensive/penalty per vehicle, which is calculated from the total monthly payment to the contractor. For the days that vehicle is not available for the company's use, it was proposed to have a fixed penalty per day, which is then deducted from the total payment to the contractor.

The proposed model includes also some other company specific features such as the volume bands and product, customer and vehicle groups, which are needed to capture the complexity of the activities and ensure the equality of the model.

The proposed model was also tested and validated during the study. Validation revealed that, when compared to the current pricing model, the proposed model can reduce the variation on the cost of driving among different routes. It can also capture the complexity of the activities in an adequate level without losing the transparency. In addition, about 80 percent of the model is aligned with the company's ERP and route planning systems. The high alignment percentage ensures that company reduces costs of the distribution, while it is optimizing its route planning. Alignment also reduces the complexity of the model and manual work to be done to calculate the payments to the contractors, as most of the data can be retrieved from the company's ERP-system.

Based on the testing in the validation phase, it can be concluded that the proposed model is as simple and transparent as possible and can still capture the complexity of the activities on an adequate level. The proposed model can also be adjusted quite easily and it increases the equality between different routes and contractors. In addition, there is a quality aspect involved, which can be seen as a feature that in long term will increase customer satisfaction.

7.2 Next Steps and Recommendations toward Implementation of the Proposal

Because of the limited testing during the study, it is recommended to make a full scale testing with a larger volumes to be able to make the last necessary fine tuning for the time-drivers. Special focus should be put to find the correct time-drivers for shelf replenishment and fixed prices and times for truck & trailer combinations, as these were excluded from this study. As the basics are already done, this should be quite easy task to do.

The proposed model is using the driving time, which is retrieved from the company's route planning software. It needs to be recognized that currently the planned driving times are not on an adequate level to be used as a basis of the pricing without losing the equality and cost efficiency. This is most likely due to the insufficient quality of master data used in the route planning, which is causing issues for the drivers to adhere the planned route. This is an area of improvement which is highly recommended to be fixed before implementing the proposed pricing model. If the drivers are adhering the planned routes, the company can also start to use planned kilometres as a basis for the payment, instead of actual kilometres. This would reduce also the need for monitoring and supervision related to the driven kilometres.

Finally, it would also be valuable for the company to investigate the possibilities to develop the route planning software, so that it would use volume bands and product groups when calculating the customer delivery times. This would increase the route planning quality and lead to a 100 percent alignment with the proposed distribution pricing model.

7.3 Thesis Evaluation

The quality of a qualitative study is typically discussed from the point of view of validity and reliability, and from some more defined criteria as well. Among other criteria, the most widely mentioned are the reliability, logic and also rigor, that later one applicable to all other criteria (Dubé & Paré, 2003, pp. 606-607)

The importance to improve *validity* of a study emerges from the need to make it clear for the reader that the approach to the data collection and research process is transparent.

Common explanation for *internal validity* is that the study should ensure that the measurements used in the study are valid and match with what was planned to be measured in the study, as visible in the research design. (Quinton & Smallbone, 2006, pp. 126-128)

In this study, validity was ensured by applying the analysis of historical data and the new measurements to the development, as well as analyzing context factors, and taking these results into notice when building a new model of the distribution pricing model. The study also took special efforts to describe the research steps in a clear way. As for validity, the results of this study can be valid only for the case organization and will not be published with all the details. Therefore it can reduce reliably only to the internal use in the case organization.

According to Quinton and Smallbone (2006), a qualitative study has three aspects of *reliability*. First, the results of the study need to be consistent, second, the measures need to be robust and third, the study should be free of random and unstable errors. Quinton and Smallbone also suggest five points which can be used to improve and strengthen the reliability of a study. Among them are, first, using a variety of different data sources, which means triangulation; second, using different data collection tools, which means triangulation of tools; third, collecting data at different points of time; next, applying established theory; and finally, using different researchers in different points of the study. (Quinton & Smallbone, 2006)

In this study, reliability was ensured, first, by utilizing wide range of data, starting from comparing historical data to new measurements, second, by collecting data during low and high season and third, by applying several individual measurers and interviewees.

In addition to the discussed criteria of validity and reliability, the criteria of *relevance* and *logic* are also evaluated, in order to ensure better quality of research process and outcomes. In this study, *relevance* was ensured by establishing a relevant business challenge from the beginning of the study, and tracing relevance through the study by relying on only relevant data sources and findings from the current state analysis, selecting the relevant theories and inputs from existing knowledge and merging them into the conceptual framework and by relevant outcome for the case company.

Finally, *the logic* was ensured by checking the entire study for the following three points defined in Section 1: the logical fit between the business challenge, objective and outcome; the logical chain of evidence through the study, and the logical choices in selecting participants, literature and focus of analysis. In the end, they all should contribute to the quality of the outcome and logically answer to the business challenge and objective.

7.4 Closing Words

At the end of this project, it needs to be admitted that the business problem assigned to this study was a true challenge as the objective was to improve something that was used very successfully for a long time. Moreover, since the pricing model has also a huge effect on the distribution's cost efficiency and quality, and it is also seen as very important for the company.

Without a large scale current state analysis that included the worktime measurement, it most likely would not have been possible to finalize the study successfully, or at least it would have been significantly harder. A large scale current state analysis provided the vital data for the proposal building and paved firm ground for its validation, and together with the conceptual framework formed the foundation for this study.

Now the project is in such a state where it can be more easily continue towards the possible implementation, if key stakeholders decide to take it into use.

8 References

Blichfeldt, B. S., & Andersen, J. R. (2006). Creating a wider audience for action research: Learning from case-study research. *Journal of Research Practice*, 4.

Dubé, L., & Paré, G. (2003). Rigor in Information Systems Positivist Case Research: Current Practices, Trends, and Recommendations. *MIS Quaterly*, 606-607.

Eisenhardt, K. M. (1989). Building Theories from Case Study Research. *The Academy of Management Review*, 534-535.

Everaert, P., & al., e. (2008). Cost Modeling in Logistics Using Time-Driven ABC - Experiences from a Wholesaler. *International Journal of Physical Distribution & Logistics Management*, 172-191. Retrieved from Emerald Insight: https://www.emeraldinsight.com/0960-0035.htm

Everaert, P., & Bruggeman, W. (2007, March/April). Time-Driven Activity-Based Costing: Exploring the Underlying Model. *Cost Management*, 16-20. Retrieved from Proquest: http://search.proquest.com.

Harold, A. (2017, March 19). *Accounting Coach*. Retrieved from Accounting Coach Web site: https://www.accountingcoach.com

Holmbom, M., Bergquist, B., & Vanhatalo, E. (2014). Performance-Based Logistics - an Illusive Panacea or a Concept for the Future. *Journal of Manufacturing Technology Management*, 958-979.

Kaplan, R. S., & Anderson, S. R. (2004, May). Time-Driven Activity-Based Costing. *Harvard Business Review*, 131-138. Retrieved from Harvard Business Review: https://hbr.org/

Kaplan, R. S., & Cooper, R. (1997). *Cost & Effect: Using Integrated Cost Systems to Drive Profitability and Performance.* Boston: Harvard Business Scholl Press.

Mäkinen, P., Virokannas, A., & Wanhatalo, P. (2017). *Publication of Cost Index for Road Transport of Goods.* Helsinki: Tilastokeskus.

Namazi, M. (2016). Time-Driven Activity-Based Costing: Theory, Applications and Limitations. *Iranian Journal of Management Studies*, 457-482.

Pirttilä, T., & Hautaniemi, P. (1994). Activity-Based Costing and Distribution Logistics Management. *International Journal of Production Economics*, 327-333.

Quinton, S., & Smallbone, T. (2006). *Postgraduate Research in Business: A Critical Guide.* London: Sage Inc.

Sols, A., Nowic, D., & Dinesh, V. (2007). Defining the Funadamental Framework of an Effective Performance-Based Logistics (PBL) Contract. *Engineering Management Journal*, 40-50.

Tilisanomat. (2017, March 19). Retrieved from Tilisanomat Web Site: http://tilisanomat.fi

Vitasek, K., & Geary, S. (2008). Performance-Based Logistics Redefines Department of Defence Procurement. *World Trade*, 62-65.

Vitasek, Kate; Geary, Steve. (2007, Summer). Performance-Based Logistics - Next Big Thing? *ProLogis Supply Chain Review*, 1-10. Retrieved from Prologis Corporation Web site: www.prologisresearch.com

Woodside, A., & Wilson, E. J. (2003). Case study research methods for theory building. *Journal of Business & Industrial Marketing*, 493.

Yin, R. K. (2009). *Case Study Research and Methods.* California: Sage Inc.

Appendix 1.

Data 1.

Field notes Interview 1. - *Confidential*

Interviewee	Pasi Lehtinen
Title	Customer Supply Chain Director
Date	6.2.2017
Duration	60 min

1. Background (current title, previous title, years in the company, etc.):

2. Relationship to current distribution pricing model:

3. Pros of current distribution pricing model:

4. Cons of current distribution pricing model:

5. Relationship to current driver fee calculation system:

6. Pros of current driver fee calculation system:

7. Cons of current driver fee calculation system:

Anything else:

Appendix 2.

Data 1.

Field notes Interview 2. - *Confidential*

Interviewee	Pekka Soininen
Title	GBS Manger
Date	7.2.2017
Duration	45 min

1. Background (current title, previous title, years in the company, etc.):

2. Relationship to current distribution pricing model:

3. Pros of current distribution pricing model:

4. Cons of current distribution pricing model:

5. Relationship to current driver fee calculation system:

6. Pros of current driver fee calculation system:

7. Cons of current driver fee calculation system:

Anything else:

Appendix 3.

Data 1.

Field notes Interview 3. - *Confidential*

Interviewee	Jussi Peltonen
Title	National Distribution Manager
Date	7.2.2017
Duration	60 min

1. Background (current title, previous title, years in the company, etc.):

2. Relationship to current distribution pricing model:

3. Pros of current distribution pricing model:

4. Cons of current distribution pricing model:

5. Relationship to current driver fee calculation system:

6. Pros of current driver fee calculation system:

7. Cons of current driver fee calculation system:

Anything else:

Appendix 4.

Data 1.

Field notes Interview 4. - *Confidential*

Interviewee	Arto Nivalainen
Title	Area Manager
Date	9.2.2017
Duration	75 min

1. Background (current title, previous title, years in the company, etc.):

2. Relationship to current distribution pricing model:

3. Pros of current distribution pricing model:

4. Cons of current distribution pricing model:

5. Relationship to current driver fee calculation system:

6. Pros of current driver fee calculation system:

7. Cons of current driver fee calculation system:

Anything else:

Appendix 5.

Data 1.

Field notes Interview 5. - *Confidential*

Interviewee	Markus Hiedanniemi
Title	National Warehouse Manager
Date	14.2.2017
Duration	50 min

1. Background (current title, previous title, years in the company, etc.):

2. Relationship to current distribution pricing model:

3. Pros of current distribution pricing model:

4. Cons of current distribution pricing model:

5. Relationship to current driver fee calculation system:

6. Pros of current driver fee calculation system:

7. Cons of current driver fee calculation system:

Anything else:

Appendix 6.

Data 1.

Field notes Interview 6. - *Confidential*

Interviewee	Gustaf Elmquist
Title	Senior Business Process Manager
Date	24.3.2017
Duration	45 min

1. What are the possibilities to use costing functions that already exist in the case company's ERP-system?

Anything else:

Appendix 7.

Data 1.

Field notes Interview 7. - *Confidential*

Interviewee	Petri Virtanen
Title	LEO Super- user / Route Planner
Date	30.3.2017
Duration	30 min

1. Introduction to the company's route planning software and its costing functions

Anything else:

Appendix 8.

Data 1.

Results of the Worktime Measurement Combined with the Actual Volumes - *Confidential*

											Delivered SKU's											Delivered litres										
Date	Measurer	Driver's Name	Driver Number	Vehicle Number	Current Weight Class	LEO Vehicle Type	Current Vehicle Type	Shipment Number	Shipment weight	Delivery Weight	BIB	BOT	CAR	CRT	DOLLY	KEG	PAL	ST	TRA	SKU's total	Mins / SKU	BIB	BOT	CAR	CRT	DOLLY	KEG	PAL	ST	TRA	Hecto-litres	Mins / Hectolitre

Collected Empties											Measured Times															
Palpa sack	Crates	Dolly	Gas bottles	Keg	Interlayer	Pallets	Palpa box	Palpa container 240	Palpa container 600	Sum of returned empty SKU's	Start Time	End Time	Duration	Customer Name	Customer Number	Customer Group	Loading Time	Driving Time	Unloading time at the Customer Site	Shelf Replenishment Time	Loading of Returning Empties & Full Goods	Unloading Time at the Crossdock	HHT Use	Break Time	Waiting Time	Other Work or Break Time