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LEAN IN DEVELOPMENT OF CAR TAX PROCESSES

Case: Company X

Bachelor's Thesis

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TIIVISTELMÄ

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Tämän opinnäytetyön tarkoitus on tunnistaa haasteita, epäkohtia ja virheitä, joita ilmenee Yritys X:n autoverotusprosessissa. Tarkoituksena on tuottaa kehittämisideoita, kuinka Yritys X:n autoverotusprosessia pystyisi parantamaan, sekä tehostamaan Lean-filosofian periaatteilla. Tämä opinnäytetyö on tehty Yritys X:n toimeksiannosta.

Tutkimus on toteutettu kvalitatiivisella tutkimusmetodilla ja tutkimuksen teoria pohjautuu Lean-ajatteluun, josta on vielä tarkemmin esitelty Lean-ohjelmistokehittäminen, ketterä ohjelmistokehitys, sekä vahvasti kytköksissä Leaniin olevat käsitteet tehokkuus, tuottavuus ja vaikuttavuus. Tutkimusta varten tehtiin myös teemahaastattelu, jossa haastateltaville lähetettiin ensin sähköpostikysely ja sen jälkeen suoritettiin kahdenkeskeinen haastattelu.

Tutkimustuloksissa tuli ilmi, että Yritys X:n autoverotusprosessi on toimiva mutta kankea. Yritys X:n tulisi tehdä muutoksia etenkin ohjelmistoon, jota käytetään autoverolaskelmien ja -simuloinnin tekemisessä. Verrattain pienillä muutoksilla käyttäjäystävällisyyteen vaikuttaviin tekijöihin pystyisi vaikuttamaan myös työn tehokkuuteen, sekä tuottavuuteen. Suurimpana kehitysideana on mainittu nykyisen ohjelmiston korvaaminen kokonaan uudella.

Avainsanat	Lean, kehittäminen, tehokkuus, tuottavuus, vaikuttavuus, autoverotus
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ABSTRACT

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The objective of this thesis was to identify the challenges, disadvantages and defects that occur in the Company X's car taxation process and to generate development ideas on how to improve Company X's car taxation process by exploiting the Lean philosophy. This thesis was commissioned by Company X.

The research was conducted by using the qualitative research method. The theoretical background was based on Lean thinking, from which Lean software development, Agile software development, and the concepts of efficiency, productivity and effectiveness were also elaborated. A semi-structured interview was conducted to gather more detailed data about the subject. The interview consisted of two elements; an email questionnaire and a face to face interview.

The results of the study showed that Company X's car taxation process was functional but cumbersome. Company X should make changes especially to the software used to calculate and estimate taxes. With comparatively small changes to the factors affecting user-friendliness could also influence the efficiency and productivity of the work. One major development idea was to replace the current software with a completely new one.

Keywords Lean, development, efficiency, productivity, effectiveness, car taxation

CONTENTS

TIIVISTELMÄ

ABSTRACT

1	INTRODUCTION	8
1.1	Objectives of the thesis	9
1.2	Restrictions/limitations	9
1.3	Structure of the thesis.....	9
2	THEORETICAL BACKGROUND	11
2.1	Definitions of efficiency-related concepts	11
2.1.1	Efficiency	11
2.1.2	Productivity	13
2.1.3	Effectiveness	15
2.2	Lean thinking	16
2.3	Lean software development	19
2.3.1	Agile development	21
3	CASE STUDY.....	24
3.1	Background & Purpose of the Project	24
3.2	Current state-analysis.....	24
3.2.1	Taxation of a single Brand X	25
4	METHODOLOGY	27
4.1	Methods.....	27
4.2	Data collection method	28
4.3	Employee interviews.....	29
4.3.1	Interview structure	29
5	RESULTS	30
5.1	Interview results.....	30
5.1.1	About the interviewees.....	30
5.1.2	The interviewees' relation to car taxation.....	30
5.1.3	The hardest brand to tax.....	31
5.1.4	Car taxation process	32
5.1.5	Problems in the process.....	32
5.1.6	The Software	33

5.1.7	Engaging with Lean	34
5.2	Suggestions for development.....	35
5.2.1	Relatively small changes to the software.....	35
5.2.2	Changing to a new version.....	36
6	CONCLUSION	37
6.1	Reliability & Validity	37
	REFERENCES.....	39

APPENDICES

LIST OF FIGURES AND TABLES

- Figure 1.** Bengt Karlöf – Efficiency Chart. p.12
- Figure 2.** Per Petersson & Mats Jackson – Productivity Chart (Karlöf 2004, Cited Per Petersson. P., Jackson. M. 2000). p.15
- Table 1.** Coplien & Bjørnvig. – Contrast between Lean and Agile. p.23
- Table 2.** Habib et al. – Overview of qualitative and quantitative research. p.28

LIST OF APPENDICES**APPENDIX 1.** Questionnaire

1 INTRODUCTION

This thesis delves into Company X's information services department's important and confidential data, its ways of operating in car taxation industry and seeks alternative ways of performing car tax processes which are more efficient and simpler.

The topic touches the Company X's customers personal information, data and strategies and therefore, in respect of these reasons, this thesis will be confidential and thus, widely used Brand X, Y, Z and W refers to a car brand.

Car taxation was first introduced in Finland in the beginning of the year 1958 by creating a car and motorcycle tax. The tax had to be paid before the registration of the vehicle, and at first it was 30% of the vehicle's taxable value. However, vehicles registered for professional traffic were exempted from the tax. The tax was supposed to be only temporary, and initially it was legislated for one year. Also, when approving the law, the parliament stated that "the tax is only temporary and a result from the state's exceptionally tense monetary situation, and the intention to give up the tax especially for cheaper price range vehicles as soon as the state finances gives it the opportunity". (Linnakangas 2007, 45-47.) This never happened and in January 2018 it was 60 years after the "temporary" car tax came into force.

Car taxation in Finland is a complex process, where multiple different factors influence the actual tax. The thesis offers solutions and thoughts for the case Company X, on how to improve their way to calculate and estimate car taxes more efficiently and on what could be done to develop a simpler car taxation process by exploiting Lean theories. The project will be done for Company X and it will focus on Brand X importer's car taxation. Company X uses an internet-based program to calculate and estimate the car taxes for different car brands. The information needed in the calculations between different brands varies and some brands need more attention than the others. This thesis focuses on how the process can be improved by exploiting Lean, what the bottlenecks are and what should be done to get rid of them.

Lean is based on Toyota Production System (TPS), which utilizes the resources as efficiently as possible. In Lean thinking, the attention is focused on to the processes and it is thought that improving them will enable developing activities with a little effort to make

activities simpler and to create more value for the customer. (Modig & Åhlström 2016, 70-74)

1.1 Objectives of the thesis

The objectives of this thesis are to recognize the challenges, defects and weaknesses that occurs in case Company X's car taxation processes and in the data needed in implementing these processes. From these findings, the goal is to give development ideas for the Company, by exploiting the Lean thinking methodology. To find development ideas, this thesis will attempt to answer the following questions:

1. What are the challenges in implementing the development plan?
2. What are the main reasons why the car taxation process is inefficient in Company X?
3. How can the car taxation process in the Company X be intensified?

1.2 Restrictions/limitations

The scope of this research is limited to only the Information and Service department in Company X and to focus on the actual goal which is to create development ideas for Company X's car tax processes.

The importing company provides Company X the data and information concerning the car tax processes, such as car prices, CO2 emissions, accessories, models etc. including everything needed in calculating and estimating the car taxes. The collection of external (Importers) data and information might face difficulties for the reason that it touches their systems and their ways of performing things, which they might not be willing to relinquish. Also, the internal (Company X) data collection is limited considering the small number of employees in the Information and Service department.

1.3 Structure of the thesis

This thesis has six chapters; introduction, theoretical background, case study, methodology, results and conclusion.

The introduction will introduce the reader to what this research concerns and relevant background information about the car taxation in Finland. Also, the research objectives,

restriction and limitations are presented as well as the research questions which this research tries to answer. The theoretical background will introduce the reader to theories called Lean, Lean software development and Agile development as well as to explain the concepts of efficiency, productivity and effectiveness. The case study chapter describes the objective of this project, analyses the current state of Company X's car taxation process and describes in detail how a single car is taxed with the software Company X is using to calculate and estimate car taxes. The methodology section introduces the reader to the relevant research methods and to the method which was chosen for this research. It also describes how the data was collected and the interviews conducted. Chapter five, the results, describes the interview results, how the results lean on to the examined theory and also development ideas are presented. The last chapter of this research ponders if the research questions have been answered and how reliability and validity actualized in this thesis.

2 THEORETICAL BACKGROUND

The previous chapter described the basic background of the study, and in this chapter will be presented those theories that this research is relying on. Relevant literature was widely studied and the main point regarding the study are described in this chapter.

Businesses can be developed and made more efficient in various ways. This chapter focuses on efficiency, concepts regarding it, Lean thinking, and how to apply Lean thinking in software development.

2.1 Definitions of efficiency-related concepts

When talking about efficiency and its development, many terms are widely used, some definitions are loose-fitting and varying especially in the colloquial language. This chapter aims to explain shortly what efficiency, productivity and effectiveness mean as well as to introduce the reader to Lean thinking.

2.1.1 Efficiency

There are multiple ways to develop and intensify businesses. For instance, the following philosophies are often connected to strategies, which aim to develop the business. These are total quality management (TQM), time-based management (TBM), just in time (JIT), Lean thinking, business process re-engineering (BPR) etc. (Neilimo & Uusi-Rauva 2014, 163)

The word “efficiency” is used daily around the globe but often it is mixed with the word “productivity” and “effectiveness”. Productivity refers to the ability to produce something without taking its value into account on the market and the latter refers to being successful or achieving these results. Both concepts are considered to be narrower than efficiency, but they are strongly connected to it and therefore this thesis also elaborates to the concepts of productivity and effectiveness. (Karlöf. 2004, 6-7)

There are numerous definitions of efficiency. Cambridge Dictionary defines it in a simply way: “The good use of time and energy in a way that does not waste any.” (Cambridge Dictionary 2018.) The two most important parameters of the concept of efficiency are based on a simple argument whereby the purpose of all organized activities is to produce value that is greater than the cost of producing the value. (Karlöf et al. 2003, 41-43)

Bengt Karlöf defines in his books that the concept of efficiency is about the relationship between value and productivity, not the value or productivity alone but its effects on each other. In business life, efficiency is essential, as it dictates the success and survival of a business. The objective is to produce value that is greater than the cost of producing and delivering it. Efficiency is about weighing resources, i.e. expenses in relation to the achieved results i.e. the value. The bigger the difference in these, the greater the efficiency, as shown in the Figure 1. (Karlöf 2004, 5-9)

Bengt Karlöf's efficiency chart:

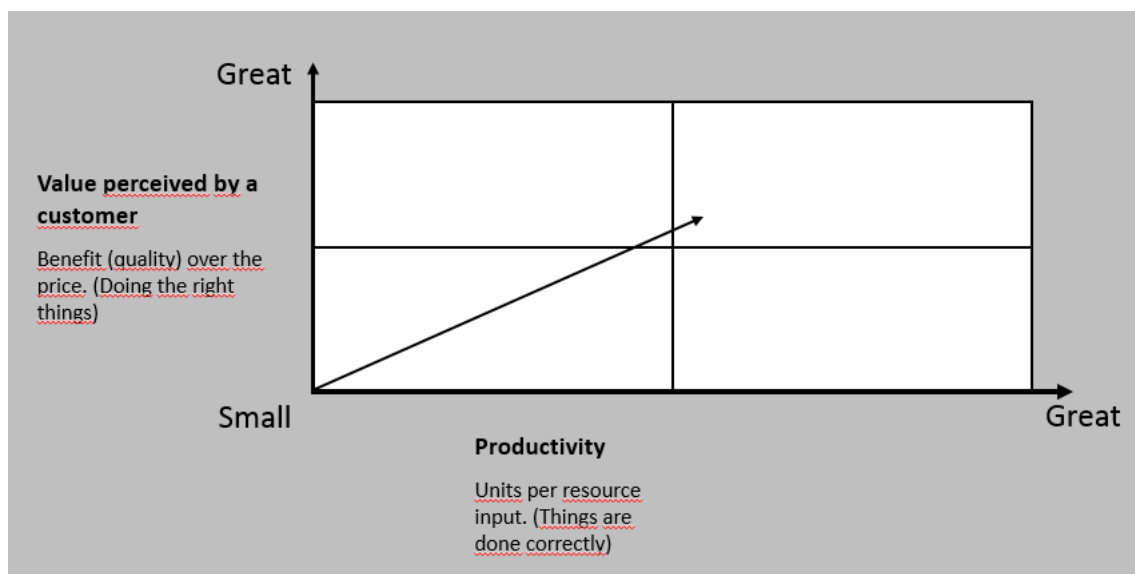


Figure 1. Bengt Karlöf – Efficiency Chart

Value means the relation between benefit (quality) and the price. Productivity in turn pertains to some producible and the expenses of a deliverable product or service.

Value as a concept means the relation between the benefit a customer receives and the cost of producing something. A close concept to value is quality. Quality is the ability of a product and service to meet the needs and expectations of a user or a customer. (Haverila et al. 2009, 21).

According to the previous paragraphs we can deduce that if we can improve the value of the results in car tax processes, or we can reduce the expenses used in the process, the process will intensify.

2.1.2 Productivity

Productivity is an expression of how efficiently and effectively products (i.e. goods and services) are being produced. There are many kinds of productivity concepts. Total factor productivity as a concept is wider than traditional concept of productivity, which in the 1970's was considered to cover the whole concept of efficiency. Productivity is defined as the cost per unit produced. It appears in the Efficiency chart as X-axis. (See Figure 1.) (Karlöf. 2004, 82; EANPC 2005, 12).

Productivity is one of the most important factors affecting the development of the national economy. The improvement of productivity increases economic growth, creates the conditions for a rise in the standard of living, reduces the pressure to raise prices and improves competitiveness. Productivity at enterprise level measures the company's ability to combine different input factors to achieve the best possible production result. The increase of productivity at an enterprise usually means directly or indirectly:

- deceleration of the company's cost development
- improvement in price competitiveness
- securing the employment
- improvement of payment of wages
- change of the nature of the work
- structural changes.

The decline in productivity, in turn, has usually an opposite impact on the factors mentioned.

One of the definitions is that the development of productivity is the basis of material well-being. Productivity needs to be increased so that money can be raised to raise wages, good public services, and a large enough volume of exports to cover import costs, and also, to make less work and consume less nature. (Haverila et al. 2009, 20-21.).

Customers, Owners, Costs and Employees. These four parameters form the foundation of COCE – model introduced by Bengt Karlöf. When it comes to a competing and added-value pursuing a company's customer, the most important thing is not the best possible efficiency but the most optimal. The COCE – model focuses on how well an organization handles its activities in relation to making its activities most optimal:

- *Customers must be satisfied and buy again.*

All organized activity begins from the customers or users, who want to make an economical or other sacrifice in order to have access to what the organization produces and provides.

- *Owners must be satisfied (in development of value or corresponding).*

Owners or shareholders are financial or psychological investors and results should be produced for them in some form. The results can be measured differently depending on the nature of the activity.

- *Costs should be relatively small, i.e. productivity is high.*

In all organized activities, the aim is to generate value that is greater than the cost of generating value.

- *Employees must be satisfied and motivated.*

Employees and other people, whose livelihood depends on the particular activity, must produce value for the customers with right costs.

The four parameters of COCE – Model should be emphasized as the fundamental factors for the success of the activity, although they do not completely exclude each other. (Karlöf 2004, 73-76.)

Partial or single factor productivity is used to be differentiated from the total factor productivity. Single factor productivity holds a risk, that the selected factor is not necessarily the factor that affects the whole entity most. However, the indicators of the single factor productivity are easy to use, and if multiple indicators are used simultaneously, they will usually give an idea of both total- and the partial factor productivity. Total factor productivity is a comprehensive concept that can refer to either the output of production in relation to a certain resource type or entity, i.e. to all resources, such as labor, capital and raw materials. Thus, the total factor productivity is a weighted expression of how well all the factors affecting productivity development are structured, enhanced and managed to produce the required result. (Karlöf 2004, 85-86; EANPC 2005. 14.)

Productivity chart found by Bengt Karlöf. (Pettersson & Jackson, 2000, Nr. 7.)

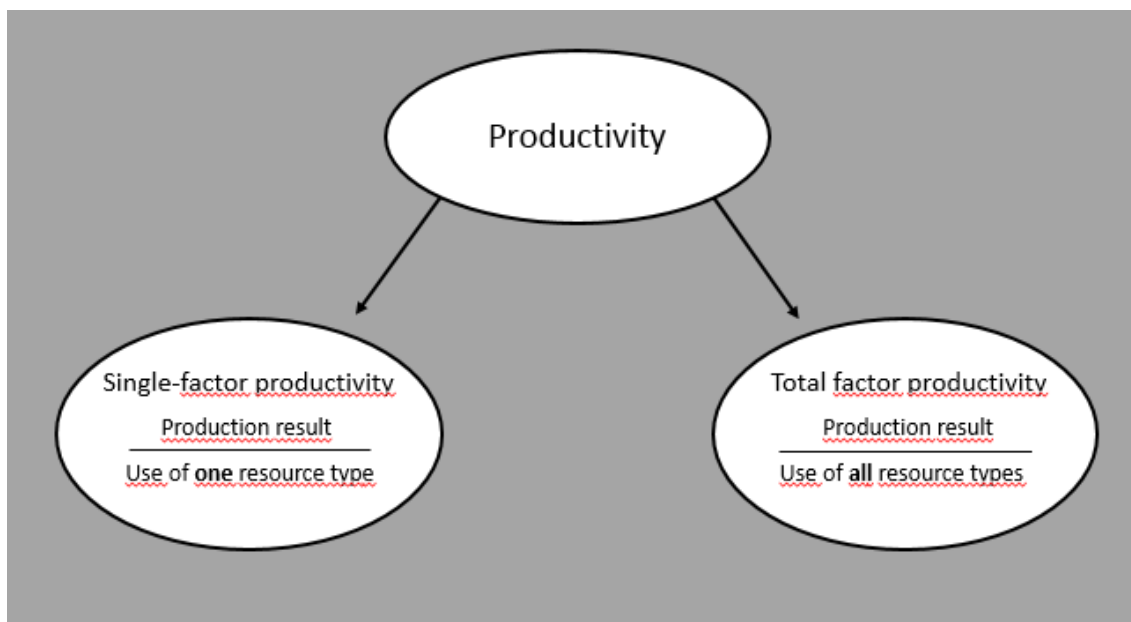


Figure 2. Per Pettersson & Mats Jackson – Productivity Chart (Karlöf 2004, Cited Per Pettersson. P., Jackson. M. 2000.)

2.1.3 Effectiveness

Effectiveness, productivity and efficiency are all close-related concepts and therefore their meaning can be mixed in everyday language albeit they all have small but remarkable differences, especially efficiency and effectiveness.

Business Dictionary defined effectiveness as follows: “The degree to which objectives are achieved and the extent to which targeted problems are solved. In contrast to efficiency, effectiveness is determined without reference to costs and, whereas efficiency means “doing the thing right,” effectiveness means “doing the right thing”.” (Business Dictionary 2018.) A small but a remarkable difference.

Organizational effectiveness can be considered to be a measure of the quality of relationship of an organization with its environment. Paradoxically, an organization can be effective but inefficient at the same time and vice versa. For instance, an organization can have a viable relationship with its environment, but it can be internally wasteful. (Pathak 2010. ch. 3.11.1)

2.2 Lean thinking

“Lean-philosophy is a way of thinking, where organizations’ and personnel’s problem-solving skills are systematically developed at the center of everything. It means a thorough and transparent assessment of the work community’s operational models and their continuous improvement” (Lean Association of Finland 2018.)

Lean is not only a method or a set of tools. It is a management philosophy that requires leadership engagement, critical review of the business processes and changing the whole corporate culture. (Liker 2004, 35.) The principle of Lean thinking is to put long-term plans ahead of organization’s short-term decision-making. The starting point is to create value to the customer, society and to the economy. (Liker 2004, 37)

As mentioned in the chapter 1, Lean is based on Toyota Production System (TPS) which utilizes the resources as efficiently as possible. In Lean thinking, the attention is focused on to the processes and it is thought that improving them will enable them to develop activities with a little effort to make activities smoother and to create more value for the customer. (Modig & Åhlström 2016, 70-74.)

Lean is a highly developed way of managing the organization by pursuing a continuous improvement of service and product productivity, quality, efficiency and value added to the customer with fewer resources. Development work is no longer just a job, but a new way of thinking that takes employee respect into account, represents the ideology of continuous improvement, in which it is important to combine development work with everyday work. The Lean thinking model is designed to create a flowing and streamlined process that generates value from the customer's needs, with no breaks or no interference. The process needs to be flowing and is designed to identify and minimize the waste occurring in the process, i.e. the steps that do not bring value to the customer and are irrelevant to the customer. The value experienced by the customer is a very broad and multi-faceted concept and can be formed for instance financially, socially and serviceable financially measurable benefits, or the difference between the benefits and the sacrifices customers have experienced. Value is always a situation-based, subjective and individual experience. (Kuusela & Rintamäki 2002, 16-17; Liker 2004; Tuulaniemi 2011 Modig & Åhlström 2016.70-74, 80.)

Lean's purpose is to optimize the time spent in activities. Delays and unproductive cycles that are not adding value are removed or at least minimized. Often development work is done at meetings and projects of a work unit and they can take from hours to a few months. Activities are continued during the project and results of the changes evaluated. Appreciating the employees in turn, does not mean free hands and comfortable working environment but it means trust, challenges, incentives, raising performance and support, but without overloading and demanding too much. The developing of a human being means developing the skills of competent employees and managers to meet the demands of their work. By operating this way quality and customer satisfaction is automatically improving as the expenses are reducing. (Liker, 2004.)

From the abstract level, the Lean model can be applied to all kinds of organizations. The flow efficiency aspect does not usually occur in organizations because organizations usually define processes according to its different functions. From a flow-efficiency point of view the flow unit is a customer and not, for example, employees. The focus is not on resource efficiency i.e. resource utilization but on flow efficiency, which also results in improved resource efficiency. In the Lean-thinking model process thinking begins from the needs of the customers, around which the processes are flexibly built. Process thinking has been renewed as a customer-oriented resource rather than a resource-driven approach. (Modig & Åhlström 2013, 18-21).

An important distinction in Lean philosophy's industrial production processes and Company X's car taxation process is that Company X's product is car tax calculation, or simulation on behalf of a customer. Understanding this also acts as a process strength, even though the product is not a tangible product, the customer must always be involved. It is possible, when production and organization is built to answer the customer's need to work with them. (Modig & Åhlström 2016, 14).

In Lean thinking, the value of the process is described as the customer's value. The value experienced by the customer is a very broad and multi-dimensional concept and it can be formed among for instance financially, socially, and financially measurable benefits derived from the service or as the difference between the benefits and the sacrifices that have been experienced. Value is always situation-dependent, subjective and individual experience. (Kuusela & Rintamäki 2002, 16-17.)

Lean approach in process development also benefits customers and staff through smooth operation and reduced mistakes and errors. Over-production and unnecessary storage of products should be avoided and consequently balancing the workload of manufacturing and service processes reduces the workload of the people and equipment. (Liker 2004, 37-38.) Improving process flow efficiency also leads to succeeding in raising its resource efficiency. The loss-functions, i.e. non-value adding functions or even inaccurate operating models are minimized. By optimizing the work models, the aim is to manage the operations with the scarcest resources available. (Modig & Åhlström, 2013, 74-76.) Stable production stream increases the predictability of the process. (Modig & Åhlström, 2013, 40-43.)

The purpose of the Lean thinking model is to create a forward flowing process with no stoppages or disturbances. The process must be flowing and derived from the customer's needs. The purpose is to identify and minimize the waste occurring in the process, i.e. the steps that do not bring value to the customer. (Kuusela & Rintamäki 2002, 16–17, Tuulaniemi 2011.)

In 2003 James P. Womack and Daniel T. Jones described five Lean principles that help to banish “muda”, a Japanese word meaning waste. The first principle, as Womack and Jones put it: “The place to start, as always, is with *value* as defined by the customer.” (Womack & Jones 2003, 28.)

Principles:

1. Value

Important is to understand what the customer wants. Thus, value can be only defined by the customer's needs of a specific product or a service and at a certain price, and at a certain time.

2. The Value Stream

The value stream consists of all the steps and processes needed to deliver a specific product or a service to a customer. From raw materials to a delivering a finished product to a customer. It is vital to identify all the steps in the value stream to be able to uncover the steps that do not add value and thus eliminate the non-value adding steps.

3. Flow

The next step is to make all the value adding steps to flow smoothly towards to the customer. This may lead to a reconsidering of the remaining steps, their place in the value stream and what should be done to create a smoothly flowing process.

4. Pull

With improved flow, the time required to go from a concept to launch or sale to delivery will decrease remarkably. This enables to deliver products or services when needed, or just in time. The idea is to let the customer “pull” the product from the producer rather than the producer pushing the products towards end user. As a result, inventory is reduced, which causes savings for both producer and the customer.

5. Perfection

Seeking perfection. All the principles above are constantly under analysis to make continuous changes in an organization and to seek better ways to identify waste, eliminate it and increase the value. (Womack & Jones, 2003. 15-28, LeanKit, 2018, CrowBrand X, 2018.)

2.3 Lean software development

As before mentioned, Lean is based on the Toyota Production System (TPS) and its purpose is to utilize resources as efficiently as possible. The same principles are the backbone of Lean software development.

Acknowledged Mary and Tom Poppendieck stated in their book *Implementing Lean Software Development: From Concept to Cash*, that software development is a form of product development and further, that most of the software's are bought as a product. Thus, the software development is only a subset of the overall product development process. However, Lean practices from product manufacturing are quite different compared to software development although they share similarities. (Poppendieck & Poppendieck 2006.)

Mary and Tom Poppendieck restated the traditional Lean principles and their tools to suit them into Lean software development and Agile software development. The principles are listed and explained below:

1. Eliminate Waste

Waste is everything that does not add value to the customer. Therefore, first it is needed to know specifically what value is and what the customer will value when they start using the software. When the value is understood, it is possible to see the waste.

2. Build Quality in

The goal is to write a code without any defects. To do that, the focus is not on putting the defects into a queue or a tracing system and to deal with them later. The focus is on avoiding the defect in the first place.

3. Create Knowledge

Code, test, deliver and discard. The knowledge gained during software development process should be accessible to everybody. (Tech Jini 2018.) Systematic learning through development process and keeping the knowledge accessible for everyone is important for an organization in order to develop continuously improving processes.

4. Defer Commitment

Irreversible decisions should be done as late as possible. Leaving critical options open until the decision must be made allows to make changes easily.

5. Deliver Fast

Software should be delivered fast enough so that the customers don't have time to change their minds. Customers making changes after ordering a product or service creates more work, or even the order can be cancelled. That is waste, and waste costs money.

6. Respect People

Respecting people means that teams are given plans and goals, but the teams are trusted to use their own thinking to achieve given goals. Thinking people are usually more engaged and focuses their efforts to create a great product. There is no "one best way" to do things and excellent leaders give the employees the power to think instead of telling what to do and when.

7. Optimize the Whole

The whole value stream should be optimized otherwise the overall value stream will suffer. The whole value stream covers the order from a customer and until

the software is deployed and the customer's needs are fulfilled. (Poppendieck & Poppendieck 2006.)

2.3.1 Agile development

In the year 2001, a group of seventeen, mostly consisting of software programmers gathered together to find a common understanding among their different approaches to software development. The participants developed a declaration called Agile Manifesto and further, several members of that meeting founded a nonprofit organization named Agile Alliance to support people exploring and applying Agile values, principles and practices to improve software development, and to make it more effective, humane and sustainable. (Agile Alliance 2018.)

The Agile Manifesto consists of four values and 12 principles, it is as follows:

We are uncovering better ways of developing software by doing it and helping other do it. Through this work we have come to value:

1. *Individuals and interactions over processes and tools*
2. *Working software over comprehensive documentation*
3. *Customer collaboration over contract negotiation*
4. *Responding to change over following a plan*

We follow these principles:

1. *Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.*
2. *Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.*
3. *Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.*
4. *Business people and developers must work together daily throughout the project.*
5. *Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.*

6. *The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.*
7. *Working software is the primary measure of progress.*
8. *Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.*
9. *Continuous attention to technical excellence and good design enhances agility.*
10. *Simplicity--the art of maximizing the amount of work not done--is essential.*
11. *The best architectures, requirements, and designs emerge from self-organizing teams.*
12. *At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly. (Beck et al 2001. Agile Alliance 2018).*

The value statements in the manifesto has a deliberate form. They are divided into two sections. The first part indicates a higher priority than the latter. However, the latter part should not be left without notice. It is also important but the authors of the manifesto value the first segment over the second segment. (Fowler, M., Highsmith, J. 2001).

Agile development and Lean shares similarities quite a lot but they do have differences as well. A clear characteristic for both methods is an aspiration to detect defects, i.e. waste, and to eliminate it. In the contrast, Lean is about complicated things and Agile is about complexity. As Lean principles are focusing on predictable and repetitive processes, Agile software development is rarely predictable. Unexpected things happen and to be agile in software development, willingness to learn and change is vital. (Coplien & Bjørnvig. 2010, 1-14).

Table 1. Coplien & Bjørnvig. – Contrast between Lean and Agile.

Lean	Agile
Thinking and doing	Doing
Inspect-plan-do	Do-inspect-adapt
Feed-forward and feedback (design for change and respond to change)	Feedback (react to change)
High throughput	Low latency
Planning and responding	Reacting
Focus on process	Focus on people
Teams (working as a unit)	Individuals (and interactions)
Complicated systems	Complex systems
Embrace standards	Inspect and adapt
Rework in design adds value, in making is waste	Minimize up-front work of any kind and rework code to get quality
Bring decisions forward (Decision Structure Matrices)	Defer decisions (to the last responsible moment)

The table above compares how Lean and Agile differentiates. Similarities can be found considerably but considering that Lean is more focused on manufacturing processes and Agile on software development, the differences are easier to understand.

3 CASE STUDY

The case study chapter explains the objective of this study and why this study is conducted as it is. It also describes in detail how daily tasks regarding car tax processes are executed in Company X's information services department.

3.1 Background & Purpose of the Project

In Finland the motor vehicle tax is a nonrecurring tax, which is paid when the vehicle is first registered in the Finnish Vehicle Traffic Register. The tax is to be paid for registered or introduced passenger cars, vans, motorcycles and some other three and four-wheel vehicles. The new vehicle's tax will be paid to the Tax Administration and the Finnish Transport Safety Agency (Trafi) is responsible for charging the car tax after the first registration. The taxpayer is the owner of a vehicle marked into the register. A car dealership carries out the car tax of a vehicle purchased from the dealership on behalf of the owner. (Valtiovarainministeriö 2018.)

Due to the car tax legislation in Finland, Company X offers taxation services for a large number of vehicle importers. The services include e.g. car tax declarations, car tax simulations, customs clearance services, pre-registration services and transfer permit management.

I have worked in Company X's information services department for multiple summers as a customs and car taxation coordinator. My daily tasks include for example car tax calculations and simulations. My supervisor, who offered this study to me, works there as a ICT- and development director. Company X has started adapting Lean philosophy recently and this thesis is a suitable continuum for its efforts to become Lean. With this thesis, I want to bring fresh thoughts and improvement ideas that will help the information and service department to succeed in its daily tasks more efficiently.

3.2 Current state-analysis

As mentioned in the introduction, this thesis focuses on Brand X, as it is identified to be one of the more challenging, if not the most challenging and hardest brand, to be taxed and simulated. In any case, Company X wants to identify the issues, the reasons for the problems and, thus development ideas to create a more efficient taxation process. This

chapter will introduce the reader to Company X's car taxation process and more specifically on, how a single Brand X vehicle is taxed.

The car tax process is a complex process, where many factors have an influence on the actualized tax. Company X calculates and simulates car taxes with a web-based program, often referred to software in this research. In the software, all the essential information of a car is visible, such as Co2 emissions, the ordered accessories, the car type and model and the prices. Each car is calculated and estimated individually in order to make sure that every detail is correct. Based on the my own experience and as a result of the interviews, most of the difficulties are derived from the importer's price lists. Each car model has its own price list for the cars and accessories, which are sent by email from the importer to Company X. After Company X receives a new price list, it is required to manually write it into an Excel file, which is then driven into the software. These price lists can change many times a year, depending on a car model. The reason for the changes comes from the manufacturer, importer or both and their need to change accessory, or car prices due to marketing campaigns etc.

3.2.1 Taxation of a single Brand X

This chapter explains step by step the process of a single Brand X's taxation.

Step 1:

Company X receives five different data files daily from the importer by email. All the files contain information on the cars that is essential in order to tax a single car. These files then are saved into a specific folder from which they are then driven into the software that is used to calculate the taxes.

When the data files have been driven into the software, all the information on the cars can be seen in the software. The files include a list of the cars that are to be taxed on that day. The daily number of the cars to be taxed varies from approximately 15 to 150. Usually the number is around 30.

Step 2:

When you choose a car from the list and feed the vehicle identification number into a search box in the software, it opens up the page for that specific car and it shows all the necessary information needed to tax the car.

Step 3:

Now that a certain car's page is open in the software, The right price list needs to be chosen for the car. The price list to be used depends on the car's model, the production date and the date when the car was sold. The price lists usually have small differences and, therefore, it is crucial to choose the correct price list in order to calculate the tax correctly and to avoid remediation of the tax.

Step 4:

After the right price list has been chosen and all the detailed information about the car is visible, all the information needs to be reviewed to make sure that it is correct. The most important points in the tax declaration are the basis of taxation, what kind of vehicle is being taxed, fuel, accessories, Co2 emissions, the price of the vehicle and today which Co2 basis is being used, WLTP or NEDC.

Step 5:

After all the steps, the tax return can be sent to the Tax Administration through the software. After sending it, monitoring is needed to ensure that the declaration went through the system and the Tax Administration received it. If something went wrong, a correction must be made.

4 METHODOLOGY

This chapter introduces and compares the relevant research methods that this study could have been based on, and discusses which research method was selected for this study. The chapter also explains how the data was collected and the last part of this chapter explains how the interviews were implemented.

4.1 Methods

Research is an investigation method that holds, for example, scholarly, scientific and systematic aspects. It aims to establish facts or principles or to gather information on a subject so that it can be presented in detail and accurately. (Habib et al. 2014, 3.) In order to distinguish the findings from the data and the results of the research, a clear research method is needed. The method consists of practices and operations that allows the researcher to produce observations, as well as the norms under which these observations can be further edited and interpreted so that their significance can be assessed as clues. The method must be consistent with the theoretical framework of the study and the method is poor if it does not give the material a chance to surprise i.e. if the researcher cannot get, even in principle, a hypotheses of his or her analysis or correctional feedback (Alasuutari, 2018. Ch. 4). There are numerous research methods that can be used but, in this study, the focus is on qualitative and quantitative methods, of which the qualitative research method was chosen to be used in this study.

Qualitative research refers in the broadest sense to research that produces descriptive data, i.e. collection of data that people have written, said, or behavior that has been observed. The aim is to develop concepts, perceptions and understanding from patterns in the data rather than examine preconceived models, hypotheses, or theories. Contrarily, quantitative research refers to counts and measures of things. Thus, qualitative research may concern more the researcher's personal experience of the subject (Taylor, S. J. et al. 2015; Habib et al. 2014.)

Table 2. Habib et al. – Overview of qualitative and quantitative research.

	Qualitative Research	Quantitative Research
Purpose	Descriptive and conclusive	Exploratory and no conclusive evidence
Sample Size	Small samples	Large samples
Question Type	Broad range of questioning	Structured questions
Interpretation	Subjective interpretation	Statistical analysis

Quantitative research involves data collection, as all research methods do. Characteristic of quantitative research method is that the collected data is usually gathered or converted into numerical form so that statistical calculations can be made to examine results and draw conclusions. Quantitative research investigates a problem that has already been identified. It is based on a theory, measured numerically, and analyzed using statistical methods. The goal of quantitative methods is to predict if the assumed generalizations of a theory are correct. Typically, quantitative research contains a survey or such with a large number of respondents to create a valid and reliable research. The sample size can be calculated by using a formula to determine how many people need to be interviewed or given a survey in order to get results that reflect the target population as precisely as needed. (Habib et al. 2014, 8-9, Creative Research Systems, 2018.)

4.2 Data collection method

Characteristic for the qualitative data is its expressive richness, multilevelism and complexity. The production of the data may be specifically organized for research, but the data consists of reports that document such situations in as much detail as possible. The accuracy and detail of a documentation is a relative matter, and it also depends on the used storage device (Alasuutari, 2018. Ch. 4). A few employees from Company X and the software provider were used for the interviews in the research. All the participants have knowledge, experience and skills in the examined matter, either in the car taxation process or the software used in car tax calculations and simulations.

4.3 Employee interviews

The main goal of the interviews is to gain comprehensive knowledge and understanding of Company X's car taxation process as well as to examine if the present software needs updating or new features. The interview is conducted as a semi-structured interview, which includes an email questionnaire and a face-to-face interview.

First the interview was intended to be sent as an email interview to the participants, but after it was tested with one person, it was noticed that the answers were not as comprehensive as desired. To get more information and more encompassing answers, the interviews was first sent as an email and later, a face to face interview was conducted. The face to face interview let the interviewer steer the conversation to the wanted direction, thus gaining more exclusive and detailed data about the investigated subject.

The interview was sent to eight people at Company X who all work either with the car taxation software or with car taxation process and seven of them agreed to be interviewed. Also, the developers of Company X's car tax software was contacted and asked briefly of their overall opinion of the software they have provided to Company X. For the software provider, a shortened questionnaire was sent for the reason that some questions were irrelevant due to their branch of industry and incompetence of answering questions concerned with Company X's car taxation process.

4.3.1 Interview structure

A feature of the semi-structured interview is that the themes have been considered, but in addition, precise questions have also been prepared, all of which are presented to the interviewees. Semi-structured interview is suitable for situations where decisions are desirable for specific issues, and therefore the interviewees are not given too much freedom during an interview. (Saaranen-Kauppinen & Puusniekka, 2006).

The interview consisted of 13 questions and the questions were asked in Finnish, due to the interviewees' mother tongue.

5 RESULTS

This chapter introduces the interview questions one by one and presents findings that emerged in the interviews. Furthermore, in this chapter, development ideas are presented based on the interviews and my personal experience.

5.1 Interview results

The ultimate purpose of the interview was to gain knowledge of how the car taxation process is done by Company X, why a specific brand is harder to tax than the others and how the interviewees would like to change the procedures of the process based on their own experience. As mentioned before (Chapter 4.3), a modified questionnaire was sent to the developers of Company X's car taxation software, however, all the answers are combined into the whole, so that no one's answers can be demerged.

5.1.1 About the interviewees

The first three questions concerned basic information about the interviewees, such as age, gender, job title and experience of working in car taxation industry. The selected interviewees included people from the age of 31 and above, while five of the interviewees were men and three women. The interviewees had a wide range of job descriptions, but the common thing for all was that everyone was working with - or had knowledge of - car taxation, car tax processes or software Company X uses for car tax calculations. The questionnaire revealed that Company X employs remarkably experienced employees working with car taxation, as the average work experience in the car taxation industry reached respectable 16,4 years among the interviewees.

Question number 1: Age and gender?

Question Number 2: Job title?

Question number 3: For how long have you been working with car taxation?

5.1.2 The interviewees' relation to car taxation

The next questions concerned information on how an interviewee's job description was related to the car tax process, which car brands they regularly tax or simulate and which

car brand they tax or simulate the most, the least and in average. Three of the interviewees calculated or simulated car taxes regularly and all of them have specialized in different car brands. Company X has gained a strong market position in Finland as it serves a network of over 30 car brands. Consequently, Company X has divided those different brands mostly between those three employees. Altogether, Company X taxed more than 40 000 cars in the year 2017. The majority of the car brands Company X is deputed to tax are taxed or simulated on a specific software designed solely for the company. Furthermore, some of the interviewees are working in information and communication technology department, one function which is to develop and support Company X's car tax systems and processes through information systems.

Question number 4: What are the tasks which belong to your job description that concern car taxation?

Question number 5: List the brands which you tax or simulate regularly.

Question number 6: Which brand do you tax/simulate the most, the least and the between? (e.g. Brand Z the most, a little less Brand X, Brand Y about the same amount as Brand X and Brand W rarely. Numbers does not matter.)

5.1.3 The hardest brand to tax

The interview continued with questions that aimed to answer which brand is the hardest and which one is the easiest to tax or simulate, and what are the reasons for that. Two brands stood out from the mass as being the hardest ones to tax or simulate, namely Brand X and Brand Y. Two of the interviewees who regularly tax and simulate Brand Y stated that Brand Y is challenging to tax. One of the interviewees also mentioned Brand X being even more challenging than Brand Y. The reasons for Brand Y being challenging is that the importer does not provide the essential information or data specifically enough. The taxation and simulation have turned cumbersome because the model needs to be selected manually, as the provided information from the importer, that is driven to Company X's system does not provide data in detailed enough form. Furthermore, accessories need to be chosen manually and there can occur overlapping accessories, e.g. an accessory package that contains the same accessories that have already been selected for the car separately. The employees are required to manually search for the model and the accessories even though they should appear automatically in the car taxation software.

Five interviewees stated Brand X to be the hardest brand to tax or simulate. The issues concerned the data files received from the importer, which contain essential information on the cars. The data is sent in multiple different files, which causes additional work. Also, price lists were mentioned, they need constant monitoring because the accessory codes change often, and the codes need to be changed manually.

Question number 7: What car brand is the hardest to tax/simulate? What makes it hard?

Question number 8: What car brand is the easiest to tax/simulate? What makes it easy?

5.1.4 Car taxation process

The aim of question number nine was to study the whole process of Company X's car tax process i.e., where it starts, or what triggers the process that ends the taxation of a car and to see if the interviewees understood the whole car taxation process. Chapter 3.2 explained the car tax process. The overall understanding of the car tax process can be considered on a good level as almost all the interviewees answered comprehensively to the topic during the face to face interview and could explain the process understandably.

Question number 9: Describe Company X's car taxation process in as detail as possible based on your own know-how.

5.1.5 Problems in the process

Questions number ten and eleven considered Company X's car taxation process as the interviewees were asked about their opinions and if they think there are non-value adding steps in Company X's car taxation process. Also, the interviewees were asked to describe what those steps are, if there are any. Question number eleven was related to question number ten as it asked the interviewees to tell how Company X's car taxation process could be developed. It turned out that the majority of the non-value adding steps can be derived from IT based solutions. In addition, these solutions are also dependent on the information that is received from the importers. Almost all of the mentioned non-value adding steps somehow considered the information received from the importers. One common aspect was that the data received is defective, thus requiring more manual work from the employees. Due to the defective data, some essential information of a certain car can be missing, such as included accessories, model or prices. Missing data forces the

employees to search or ask for it in order to successfully calculate or simulate a car's tax. The data can be inquired for from the importer, which will cause delays in taxation, as the process stops while the employee is sending emails and waiting for the answers.

The interviewees offered many different improvement or development ideas for the car taxation process. Some interviewees considered this question at a grass roots level as they gave improvement ideas on how to improve and make their own work more efficient. Also, some of the interviewees even suggested changing the whole car taxation software to another software. Brand Y and Brand X being the hardest ones to tax or simulate, the improvement ideas concerned mostly these two brands and especially the data received from these two importers. As a conclusion, the interviewees wanted a solution for the IT problems, correctness of the data in the files received from the importers and possibly a replacement for the current car taxation software.

Question number 10: Are there any non-value adding steps in Company X's car taxations process in your opinion? What? (e.g. Information needed in taxation is missing from the software? What else?)

Question number 11: How do you think that Company X's car taxation process could be developed?

5.1.6 The Software

Questions number twelve and thirteen concerned the software Company X is using to calculate and estimate the taxes. The interviewees were asked to describe the pros and cons of the software as well as their overall opinion of it and if they wanted to change it somehow. The overall opinion of the software was positive although the interviewees were eager to give improvement and development ideas for the software. One interviewee mentioned as a pro that the software is developed to comply with the regulatory requirements concerning the car taxation in Finland, therefore it contains almost no additional and unnecessary features, but it contains all that is needed. The interviewee also stated that since the car taxation processes or regulations rarely change there is not much in maintaining the software. It was also mentioned that from the software's technological aspect, it is relatively flexible for changes even though it has been programmed step by step over time, which makes its maintenance, updating, developing and usability harder. The interviewees also mentioned that the software holds a lot of restrictions that result

from the outdated user interface. With usage of modern equipment, the user interface could be developed to be much more user-friendly and more stylish. Without prioritizing resources and thinking of expenses, Company X's software could have been renewed thoroughly. However, because of Finland's car taxation software market area is currently satisfied and no sales are expected in the near future, the development of such software has not been seen economically worthwhile. The software received a small minus concerning its technology, which begins to gradually become obsolete. However, as mentioned above, this negative feature is relatively small, because the technology is even today widely used and supported with current operating systems. Still, some interviewees would rather substitute the whole software with another one.

The rest of the interviewees considered the questions mostly from a daily use perspective and the improvement ideas concerned mostly the appearance of the software. The ideas included, for example, a comment box only for Company X's purposes as the current comment box sends all the notes to the Tax Administration office when a car is taxed. Also, the accessories are currently shown as a list of ten accessories and there might be even 70 different accessories that can be chosen for a single car and the interviewees wanted the accessory list to show more accessories at a time.

Question number 12: What are the pros and cons of the software used in car tax calculations and estimations?

Question number 13: What is your opinion of the software? Is it good as it is, or would you like to change it somehow? How?

5.1.7 Engaging with Lean

To view the results of the interview in the perspective of the examined theory, some conclusions can be drawn from the answers. This thesis was conducted in the first place, as it was a common conclusion that Company X's car taxation process was not perfect. As Lean's fifth principle points out, perfection is unattainable but pursuing it by continuous improvement is the aim of Lean. (LeanKit 2019.)

In the interview question number 9 (*Describe Company X's car taxation process as detailed as possible based on your own know-how*), the aim was to make the interviewees view the whole process as they see it based on their own knowledge and experience, thus

clarifying the whole process for themselves. Question number 9 prepared the interviewees to the next two questions, which aimed to seek the non-value adding steps in the process following how the process could be developed. In order to make the processes lean, it needs to be known what adds value to the process, because everything else can be considered waste, which should be eliminated. The second principle of Lean is The Value Stream, it consists of all the steps and processes needed to deliver a specific service to a customer. All the steps need to be identified in order to be able to uncover the non-value adding steps. The question that sought developing ideas is associated with the Lean principle number 3., The Flow. As the value adding steps are identified, it usually leads to reconsidering the remaining steps, their place in the value stream and how the process should be rebuilt to create a better flowing process. (Womack & Jones, 2003. 15-28, LeanKit, 2018, CrawBrand X, 2019.)

Regarding Lean software development and Agile development, the last two questions asked about the software Company X uses to calculate and estimate the taxes. Lean software development and Agile development share many similarities with Lean, but they do have differences as well. However, the main goal for all of these is to eliminate waste and create a well flowing process.

5.2 Suggestions for development

As the theory suggests, Lean thinking is a continuous journey. Becoming a Lean organization or making processes Lean does not happen overnight.

This chapter aims to give concrete development ideas and thoughts for Company X regarding its car taxation process based on the examined theory, interviews and my own experience at the case company.

5.2.1 Relatively small changes to the software

During the interviews it turned out that with only relatively small changes the software could be developed to be a lot more user-friendly, which would lead to more efficient work. To make the use of the software more convenient, and thus efficient, it would be good if the user could search for a specific vehicle with vehicle identification number (VIN) from all the importers, as now it is restricted in a way that first the importer must be chosen and then it is possible to search only for that importer's vehicles. The search

should include all the importers in order to avoid pointless clicks and to make the using of the software easier and more convenient. Also, some vehicles might have a long list of accessories that can be chosen. Currently the software shows only ten accessories per page. If the vehicle has, for example 80 accessories in a worst-case scenario, it is required to go through eight pages until you find that certain accessory. In order to avoid that, it would be time saving if the accessories could all be seen on one page. A similar matter to the previous, when estimating car taxes, only ten VIN's are visible on a page. Often each of them is waiting for something, such as information about the accessories, and the employee is then required to click to the second, third, fourth page etc. until he/she finds a car that is ready for the estimation. By expanding the 10-object list to 30-50 items would save time and effort of the employees. Also, the interviewees who were using the software in their daily tasks mentioned that a comment box for their use only would be good, as the current comment box will also send the text of the box to the Tax Administration. The comment box would be good, because some cars might have to wait for something, for instance an updated price list until they can be taxed. The comment box for the Company X would allow writing notes about the car only for internal use without the fear that Tax Administration would see it.

As mentioned in chapter 3.2.1, Company X receives five different data files daily from the importer in order to get all the necessary information on the cars to be taxed. These five data files should be combined into a one file which includes all the information about the cars. It would ease the monitoring that all the necessary information has been transferred to the software. This cannot be solved solely by Company X and it requires liaison with the importer in order to reduce the number of daily data files, or combining those daily five different data files into one file.

5.2.2 Changing to a new version

The interface of the current software has many limitations due to outdated technology. By using modern implementations, the user interface would have a much more elegant appearance and a better user experience. As a few interviewees suggested, the software should be abandoned in the near future. The transition would cost money and time, but the advantages of a new system could make it worthwhile. If Company X decides to change into using a whole new system, it should definitely involve the employees who are estimating and calculating the taxes daily into the process.

6 CONCLUSION

This research examined the car taxation process at Company X and focused mostly on Brand X, which is the most troublesome brand to be taxed according to the findings of this research. This thesis utilized theories such as Lean, Lean software development and Agile development. Company X has currently a working but cumbersome car taxation process, of which all the slightest details are only known by experienced and adept employees. There is a lot more to be improved in the car taxation process than this thesis suggests but this can be considered as a start. The biggest suggestion was to change the outdated software into a new one, which would be big transition in the process of achieving more efficient car taxation process.

As presented in chapter 1.1, the objectives of the research, the research aimed to answer the following questions:

1. What are the challenges in implementing the development ideas?
2. What are the main reasons for the inefficient car tax process in Company X?
3. How can the car taxation process at Company X can be intensified?

Now it can be concluded that this thesis managed to answer these research questions but not as comprehensively as desired in the beginning of the project due to the limited resources and the scope of this work.

6.1 Reliability & Validity

The basis of a research is to produce reliable information. In order to detect possible mistakes in the thesis, it is important to take reliability and validity into account in order to achieve better credibility.

The reliability of a research means repeatability, meaning that, if done again, the research produces the same result as the previous research. Considering the scope of this qualitative research, if done again, the results would probably be at least slightly different. As this research was conducted over a relatively long period of time, some things have changed, even in the legislation of car taxation in Finland, thus affecting the reliability of this thesis. However, this thesis focused mostly on improving a certain brand's car

taxation process, including the software improvement, similar findings would be made in future researches, if they were conducted with the exact same scope of the research.

The validity of a research means that the meter and the used research method measure what they were planned to measure. Sometimes the interviewees might understand the questions differently than the researcher meant or sometimes the researcher's own experience can affect the results. (Hirsjärvi, Remes & Sajavaara 1997, 226. Hirsjärvi et al. 2001, 213). As the principal of this research has started implementing Lean in its daily tasks and processes, they suggested following the same path and using the Lean theories in carrying out this research. As it was desired to examine methods in developing Company X's car taxation processes, Lean was a suitable theory to be used. As mentioned in chapter 4.3, the interviews were planned to be carried out only as an email interview but as a result of one test interview, it was noticed that the answers were not comprehensive enough. This led to a face to face interview, which was more suitable for this whole research. It enabled the steering of the interview to the wanted direction, thus giving more detailed information regarding the research subject.

All in all, the reliability of this research is a two-sided matter. If a different researcher would conduct the same research, he/she would find some similar results but also, he/she would probably find different ideas for development as well. The same applies also to the validity of this research. The interview questions could be different, thus producing different information from the interviewees. However, the interview that was used in this research, gave answers to all the matters that were supposed to be measured in this research.

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APPENDICES

Appendix 1: Questionnaire

Question number 1: Age and gender?

Question Number 2: Job title?

Question number 3: For how long have you been working with car taxation?

Question number 4: What are the tasks belonging to your job description that considers car taxation?

Question number 5: List the brands which you tax or simulate regularly.

Question number 6: Which brand you tax/simulate the most, the least and the between? (e.g. Brand Z the most, a little less Brand X, Brand Y about the same amount as Brand X and Brand W rarely. Numbers doesn't matter.)

Question number 7: Which car brand is the hardest to tax/simulate? What makes it hard?

Question number 8: Which car brand is the easiest to tax/simulate? What makes it easy?

Question number 9: Describe the Company X's car taxation process as detailed as possible based on your own know-how.

Question number 10: Is there any non-value adding steps in Company X's car taxations process in your opinion? What? (e.g. Information needed in taxation is missing from the software? What else?)

Question number 11: How would you think that the Company X's car taxation process could be developed?

Question number 12: What are the pros and cons of the software used in car tax calculations and estimations?

Question number 13: What is your opinion of the software? Is it good as it is, or would you like to change it somehow? How?