



# OPTIMIZING RESOURCES AND PRODUCTION IN CALL CENTER SERVICE

**Anne-Mari Lappi**

Bachelor's Thesis in Industrial Management

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Author(s) Anne-Mari Lappi			
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<p>Abstract</p> <p>The main goal of this thesis was to develop production efficiency and study Enterprise Resource Planning programs for a contact center. The goal was to find out the main aspects which needed improvement and develop resource scheduling.</p> <p>The study was carried out by interviewing employees and superiors of the target company and other companies. For Enterprise Resource Planning program, the study was implemented by testing several programs and presentations by companies.</p> <p>Originally benchmarking was planned to be carried out by interviewing different companies. The willingness to share knowledge became a problem and interviews were carried out inside the target company. The results from the interviews were illustrative and similarity in answers was surprising. According to the results, the main problem was that employees felt that their work was not valued.</p> <p>These interviews give a good start for the company to study deeper ways to improve problems which came up during the interviews. The client will have better idea what should be done to achieve their goal as a constantly developing company.</p>			
<p>Keywords Benchmarking, Lean, Flow Efficiency, Resource Efficiency, ERP, Production Efficiency</p>			

## CONTENTS

1	INTRODUCTION .....	6
1.1	Background information of the company.....	6
1.2	Problems and objectives of the study .....	6
1.3	Research methods .....	7
1.4	Structure of the thesis.....	7
2	BENCHMARKING, LEAN AND ERP .....	8
2.1	Benchmarking .....	8
2.1.1	Different types of benchmarking processes.....	8
2.1.2	Benchmarking as a process.....	11
2.2	LEAN .....	13
2.2.1	Main principles of LEAN .....	14
2.2.2	Resource efficiency .....	15
2.2.3	Flow efficiency .....	16
2.2.4	Resource efficiency versus flow efficiency.....	17
2.2.5	Matrix of efficiency .....	19
2.2.6	Implementation of lean.....	20
2.3	Enterprise Resource Planning systems.....	20
3	CURRENT STATE OF THE COMPANY.....	22
3.1	Introduction to the current state of the company .....	22
3.2	Implementation of production planning .....	22
3.2.1	Resource efficiency in Company X .....	22
3.2.2	Flow efficiency in Company X.....	23
3.3	Tools for enterprise resource planning so far.....	23
3.3.1	Emce .....	24
3.3.2	Esmikko .....	24
3.3.3	Smartrex .....	26
3.3.4	Intranet.....	27
3.3.5	Lotus Notes .....	27
3.3.6	Spreadsheet tables.....	27
3.4	Problems in Company X .....	29
4	RESULTS.....	30
4.1	Production efficiency.....	30
4.2	Resource scheduling .....	32
4.2.1	Comparison of ERP systems .....	32
4.2.2	Spreadsheet as a tool.....	33

5 CONCLUSIONS.....35  
REFERENCES.....36

APPENDICES

- Appendix 1 Interview results of the superiors
- Appendix 2 Benchmarking results outside of the Company X
- Appendix 3 Benchmarking results inside the Company X
- Appendix 4 Comparison of ERP programs

## ABBREVIATIONS AND DEFINITIONS

ERP	Enterprise Resource Planning
TQM	Total Quality Management
Benchmarking	Learning from the companies which are experts in their field of expertise
Lean	Strategy to improve company and its processes
Just-in-time	Production strategy which aims to improve company's processes and reduce inventory
Kaizen	Philosophy which purpose continuous improvement
One-piece flow	Helps to achieve just-in-time production
Jidoka	Automation with human touch
Heijunka	Leveling workload
Pull system	Manufacturing on demand. Low inventory
Genchi genbutsu	Means go and see, Toyota principles
Hansei	Identifying mistakes and developing measures to avoid same mistakes
Emce	Financial Management system
Esmikko	Access control system
Smartrex	Scheduling tool
Lotus Notes	Email and event register
TES	Collective labor agreement

## 1 INTRODUCTION

### 1.1 Background information of the company

The author of this thesis was bound by the bond of secrecy. Caused by the bond of secrecy, the company name stays unrevealed. Company will be referred as Company X.

Company X is a contact center established in the middle of 2000. Company is mainly located in one city but has several offices in other cities as well. Company has at the time of this study approximately 130 employees.

Company X offers different kinds of contact center services such as customer service, telemarketing, switchboard, helpdesk, and back office. Mainly the services are provided at office hours, but some require round the clock services. The services are provided in Finnish, English and Swedish.

### 1.2 Problems and objectives of the study

Company X has searched a tool for scheduling the resources, in order to allocate the right people are at the right places at the right times. The difficulty in the scheduling is, that there are so many aspects which need to be taken into account. Such as season, holidays, midweek holidays, events and weather. In addition to this, there are some limitations, which affect the scheduling, and these are know-how and employees who make certain shifts only. In some cases work needs to be defined in the accuracy of 15 minutes. Besides these challenges, predictability of the work hours is one major thing, which must be taken into account.

These aspects limit the supply of scheduling tools. The scheduling was done manually by using spreadsheet for predicting the work load, and Smartrex as the scheduling tool. Smartrex does not provide all the alternatives which are necessary and it is outdated. Predicting with spreadsheet was laborious and obscure.

Other angle to the study is to recognize what are other problems which can affect the growth of the company. Study will include how to make production more efficient, and methods how the quality remains good, so that customers and employees are satisfied.

The objective was to find a tool by which time management was more controlled and work load could be predicted. Other objective for the study is to locate problems which can cause problems to the growth and find a solution or alternatively tools to solve occurring problems.

### 1.3 Research methods

The study was carried out by interviewing employees and superiors of Company X and other companies. Results from interviews are used as a basis for benchmarking and lean which are methods used in the study.

To find scheduling tool, applications were searched from internet, companies presented their programs and programs were tested. All the information of these presentations was written down, evaluated and payback time calculated.

Material to support this study and methods was gathered from internet and school library.

### 1.4 Structure of the thesis

This thesis is divided into five chapters. The first chapter is introduction, where the company, problem and objectives of the study and research methods are introduced. Second chapter is about theory. It includes introduction and applications of the methods used in the study. In the third chapter current situation of the company is presented. The fourth chapter presents the results which were gathered during the study. In the last chapter the final conclusions are presented.

## 2 BENCHMARKING, LEAN AND ERP

Each company has its own strategy to manage company's production, and every company has always something to improve to make production more efficient. There are several ways to approach company's problems. For this study were chosen benchmarking, lean and Enterprise Resource Planning, ERP system. In this part Benchmarking, Lean and ERP are introduced from the theoretical point of view.

### 2.1 Benchmarking

Benchmarking means learning from the companies which are experts in their field of expertise. It doesn't necessarily mean that the company one is learning is from same area of expertise as own company. The company chosen for benchmarking should have the best methods and approach to lead company. (Tuominen 1993, 15)

By benchmarking process it is possible to recognize, understand and adapt the best methods and procedures for the company. By using benchmarking company is aiming to improve the efficiency. (Tuominen 1993, 15)

Companies can recognize the problem areas which need improvement by using benchmarking. When processes and problem areas are defined, you need a company which to compare. Next phase is to analyze the company and processes. (Karlöf & Östblom 1993, 33-34)

Originally benchmarking was developed in Japan as a technique to improve quality. Since that Rank Xerox was the one who started benchmarking in 1976. The method has been improved and it is a part of Rank Xerox's Total Quality Management, TQM program. (Tuominen 1993, 16)

#### 2.1.1 Different types of benchmarking processes

There are different ways how benchmarking types are defined; this depends from author's point of view. Tuominen (1993, 18) presents benchmarking types in three groups according to content. Groups are strategic benchmarking, performance benchmarking and process benchmarking. These groups and definitions are presented in Table 1.



TABLE 1. Types of benchmarking (Tuominen 1993, 18-21).

Type of benchmarking	Definition
Strategic benchmarking	<ul style="list-style-type: none"> <li>- Used as a tool for measurable strategic goals and search of alternative methods</li> <li>- Both short-term and long-term goals. These can be done simultaneously to different companies.</li> </ul>
Performance benchmarking	<ul style="list-style-type: none"> <li>- Comparison of performances</li> <li>- Can be performed by observing and collecting data from single product or its process</li> <li>- More valuable information can be received when studying the company's entire production key processes.</li> </ul>
Process benchmarking	<ul style="list-style-type: none"> <li>- Analyzing your own and benchmarking company's business processes</li> <li>- By analyzing can be determined, described and compared the methods and procedures for the process which performance is examined</li> <li>- Determine the requirements which are essential when applying methods and procedures.</li> </ul>

In benchmarking guide Hotanen, Laine and Pietiläinen (2001, 8-9) introduce the most common ways to do benchmarking. These six different benchmarking types are characteristic comparison, process benchmarking, competitor benchmarking, dyadic benchmarking, group benchmarking and partnership benchmarking (table 2).

TABLE 2. The most common types of benchmarking (Hotanen etc. 2001, 8-9).

Type	Definition
Characteristic comparison	<ul style="list-style-type: none"> <li>- Not quite benchmarking</li> <li>- Comparison of performance to outcome</li> <li>- Does not reveal essential parts such as how performance is accomplished.</li> </ul>
Process benchmarking	<ul style="list-style-type: none"> <li>- Comparing company's own processes to benchmarking company</li> <li>- By this benchmarking method major step in development is gained.</li> </ul>
Competitor benchmarking	<ul style="list-style-type: none"> <li>- Can be either characteristic or process benchmarking</li> <li>- Possible to overlook functional perspective, because of challenging data collection.</li> </ul>
Dyadic benchmarking	<ul style="list-style-type: none"> <li>- Comparison of two organization's processes and procedures</li> <li>- Interactive benchmarking.</li> </ul>
Group benchmarking	<ul style="list-style-type: none"> <li>- Collecting data from own processes</li> <li>- Followed by comparison of an ideal process model to selected company's processes</li> <li>- Benchmarking done is several steps.</li> </ul>
Partnership benchmarking	<ul style="list-style-type: none"> <li>- Can be either dyadic or group benchmarking</li> <li>- Done with cooperation partner.</li> </ul>

According to Karlöf and Östblom (1993, 67-73) benchmarking is divided to following three types: internal benchmarking, external benchmarking and functional benchmarking (table 3).

TABLE 3. Definitions of benchmarking types (Karlöf &amp; Östblom 1993, 67-73).

Type	Definition
Internal benchmarking	<ul style="list-style-type: none"> <li>- Can be used in a company which has offices in several cities or countries</li> <li>- Comparison done inside own company, in which processes are possible to compare.</li> </ul>
External benchmarking	<ul style="list-style-type: none"> <li>- Comparing processes to other company with similar processes</li> <li>- Vital that processes can be compared to each other.</li> </ul>
Functional benchmarking	<ul style="list-style-type: none"> <li>- Comparing company's own services and processes to other companies from any field of expertise</li> <li>- Goal is to find company which has succeeded exceptionally in business.</li> </ul>

### 2.1.2 Benchmarking as a process

Very simple and illustrative way of describing benchmarking as a process is presented by Karlöf and Östblom (1993, 77) in figure 1.

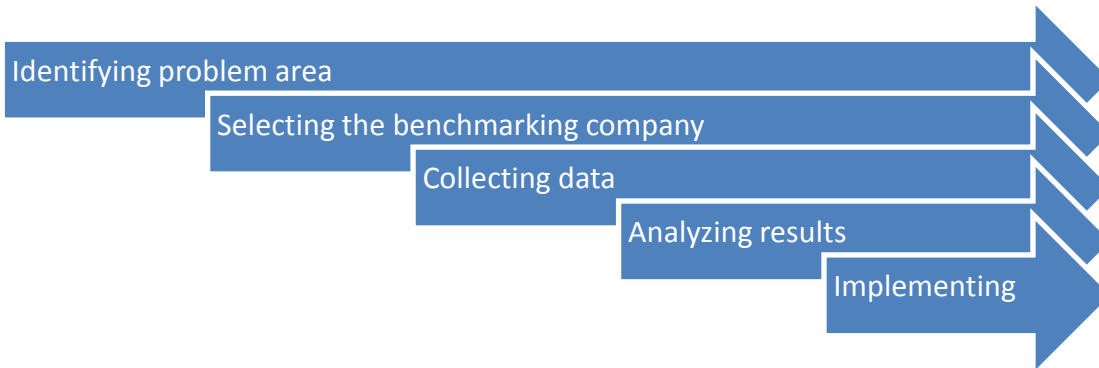


Figure 1. Benchmarking process (Karlöf&Östblom 1993, 77).

These phases can be shortly described in table 4. (Karlöf&Östblom 1993, 92-94)

TABLE 4. Description of benchmarking process (Karlöf & Östblom 1993, 92-94).

Phase 1: Identifying problem area	<ul style="list-style-type: none"> <li>- Based on needs of the company</li> <li>- Identifying the areas which need to be improved and are vital for success.</li> </ul>
Phase 2: Selecting the benchmarking company	<ul style="list-style-type: none"> <li>- Identifying which companies are experts in their field of expertise</li> <li>- Comparing processes and adaptability</li> <li>- Finding a way to cooperate with company from the benchmarking point of view.</li> </ul>
Phase 3: Collecting data	<ul style="list-style-type: none"> <li>- Collecting data from the company, its processes and performance.</li> </ul>
Phase 4: Analyzing results	<ul style="list-style-type: none"> <li>- Similarity and differences between companies are defined.</li> </ul>
Phase 5: Implementing	<ul style="list-style-type: none"> <li>- Implementation of the measures which are got from results</li> <li>- Goal of implementation need to be realistic.</li> </ul>

## 2.2 LEAN

In the 1980's Toyota was noticed all over the world because of the Japanese quality and efficiency. Cars made in Japan lasted longer and needed less repair compared to Americans. Compared to other car manufacturers in Japan, by the 1990's it was clear, that Toyota was unique. Toyota's way to design and manufacture car in a fast and consistent way caught the attention everywhere in industrialized countries. Cars were competitive in the market, although payments for workers were quite high. Addition to Toyota's way to manufacture cars, it was astonishing how company bounced back when troubles occurred and became more competitive. (Liker 2004, 3)

Toyota's operational excellence has resulted in company's consistent way to execute. Just-in-time, kaizen, one-piece flow, jidoka and heijunka are the basis of Toyota's operational excellence. These tools and quality improvement methods became known to industry by Toyota, and launched the revolution of lean manufacturing. However these tools and techniques are not the straight answer to success. At the background one has to understanding people and their needs. Development of organization and constant learning are the foundation of success. (Liker 2004, 6)

The famous 14 Toyota way principles form the Toyota way (table ) (Liker 2004, 36).

TABLE 5. The 14 Toyota Way Principles (Liker 2004,37-40).

1. <i>“Base your management decision on a long-term philosophy, even at the expense of short-term financial goals”</i>	8. <i>“Use only reliable, thoroughly tested technology that serves your people and processes”</i>
2. <i>“Create continuous process flow to bring problems to the surface”</i>	9. <i>“Grow leaders who thoroughly understand the work, live the philosophy and teach it to others”</i>
3. <i>“Use “pull” systems to avoid overproduction”</i>	10. <i>“Develop exceptional people and teams who follow your company’s philosophy”</i>
4. <i>“Level out the workload (heijunka). (Work like tortoise, not the hare)”</i>	11. <i>“Respect your extended network of partners and suppliers by challenging them and helping them improve”</i>
5. <i>“Build a culture of stopping to fix problems, to get quality right the first time”</i>	12. <i>“Go and see for yourself to thoroughly understand the situation (genchi genbutsu)”</i>
6. <i>“Standardized tasks are the foundation for continuous improvement and employee empowerment”</i>	13. <i>“Make decisions slowly by consensus, thoroughly considering all options; implement rapidly”</i>
7. <i>“Use visual control so no problems are hidden”</i>	14. <i>“Become a learning organization through relentless reflection (hansei) and continuous improvement (kaizen)”</i>

### 2.2.1 Main principles of LEAN

Main principles of the lean can be divided into two groups: leadership principles and operation modes. These principles are explained in table 6. (Kajaste & Liukko 1994, 8)

TABLE 6. Main principles of lean (Kajaste &amp; Liukko 1994, 8).

<b>Leadership principles</b>	<ul style="list-style-type: none"> <li>- Result is done in co-operation</li> <li>- Clear targets, indicators and follow-up</li> <li>- Delegation of profit responsibility and multipolar organization</li> <li>- Skilful and active workers</li> <li>- Common interest of client, owner and workers.</li> </ul>
<b>Operation modes</b>	<ul style="list-style-type: none"> <li>- Added value for customer</li> <li>- Paying attention to bigger picture</li> <li>- Constant improvement of cost structure</li> <li>- Straight and open information flow</li> <li>- Constant cultivation</li> <li>- Flexible and fast supply chain</li> <li>- Joining human resources to current industrial engineering.</li> </ul>

### 2.2.2 Resource efficiency

Resource efficiency means simply use of resources in the best possible way and it is very traditional form of efficiency. For over 200 years the success in industry has based on improving resource efficiency. One of the main principles of resource efficiency is that work is divided to smaller parts and given to several employees to complete. Aiming at economies of scale is the second principle. Practically this means that smaller tasks are joined together for individuals, part or entire organization to complete repeatedly. (Modig & Åhlström 2013, 9)

Resource efficiency remains to be the natural way to approach efficiency. By monitoring resource efficiency one can measure how much a resource is used in a certain period of time. Targets of monitoring can be devices, employees and in a more abstract level departments and organizations. It is very important in organization level that all resources are used in an efficient way and without idle time. (Modig & Åhlström 2013, 9-11)

In table 7 there is a good example by Modig and Åhlström (2013, 10) how resource efficiency is calculated from the point of view of health care.

TABLE 7. Resource efficiency from a certain time period (Modig & Åhlström 2013, 10)

<b>Resource:</b>	<i>Magnetic camera</i>
<b>Usage time of resource:</b>	<i>6 hours</i>
<b>Time period:</b>	<i>24 hours</i>
<b>Resource efficiency:</b>	<i>6 hours/24 hours = 25 %</i>

In example shown in table 7, according to the resource efficiency camera is used only for a quarter from the time period. If the time period would be shorter and usage time would remain the same, naturally the resource efficiency would be better. (Modig & Åhlström 2013, 10)

If resources are not used efficiently company will suffer opportunity cost. If resources are not used entirely, reserved assets can be used to something else. (Modig & Åhlström 2013, 11)

### 2.2.3 Flow efficiency

Modig and Åhlström (2013, 13-14) define flow efficiency as a “*new form of efficiency*”. In flow efficiency resources are not the focus, but how fast does for example a product flow through process.

In flow efficiency the attention is focused on refined unit of an organization. Whether we are talking about industry, where the product is, or customer service, where is customer. In flow efficiency monitoring is focused on how quickly a product or customer flows through organization. Unit which flows through organization is called flow unit. In flow efficiency the amount of refining done in a certain time period is measured. Measuring begins from identifying the need until the need has been fulfilled. Examination of flow efficiency is done from the point view of flow unit. And more specified, according to the time flow unit gets value. It demonstrates how well organization refines their flow units and does a unit receive value. (Modig & Åhlström 2013, 13-14)

Modig and Åhlström (2013, 13) present an example of flow efficiency from the point of view of health care. This calculation is shown table 8.



TABLE 8. Calculation of flow efficiency (Modig &amp; Åhlström 2013, 13)

<b>Need:</b>	<i>Sore throat</i>
<b>Value added time:</b>	<i>Spend time with doctor and personnel (10 minutes)</i>
<b>Time period:</b>	<i>Total time spent in health center (30 minutes)</i>
<b>Flow efficiency:</b>	<i>10 minutes/30 minutes = 33 %</i>

In the example in table 8, flow efficiency is 33 percent which means customer receives value 33 percent of time spent in health center. In the example waiting time is not value added time. (Modig & Åhlström 2013, 14)

The key elements in flow efficiency are value and need. When assessing value added time, it is considered from the point of view of flow unit. Most important is the time when flow unit receives value. (Modig & Åhlström 2013, 23)

When observing flow efficiency, it is not about speeding value added actions. It is about maximizing frequency of value transfer and getting rid of non-value added actions. (Modig & Åhlström 2013, 28)

#### 2.2.4 Resource efficiency versus flow efficiency

In the table 9 is shown an example of health center by Modig and Åhlström (2013, 15), where resource and flow efficiency are compared. Example is shown from the point of view of flow efficiency.

TABLE 9. Resource efficiency compared to flow efficiency (Modig &amp; Åhlström 2013, 15)

	<b><i>X treatment system</i></b>	<b><i>Y treatment system</i></b>
<b><i>Primary stress</i></b>	<i>Resources</i>	<i>Needs</i>
<b><i>Number and forms of contacts</i></b>	<i>Several, different forms of contacts</i>	<i>One, one visit</i>
<b><i>Time elapsed from first time contact to diagnose</i></b>	<i>42 days</i>	<i>2 hours</i>
<b><i>Flow efficiency</i></b>	<i>0,2 %</i>	<i>67 %</i>

Nowadays resource efficiency is the current form of efficiency. For a company it is vital to use resources in an efficient way. However, equally important it is to fill needs of customers. In order to be successful and with high quality, both forms of efficiency needed. Best solutions for a company would be to aim both resource and flow efficiency. This sounds good, but it is very difficult to combine these together. (Modig & Åhlström 2013, 15-16)

In resource efficiency, main focus is in use of resources and in flow efficiency how quickly flow unit proceeds through process. In order to maintain good resource efficiency it is important to have all the resources in use all the time. For flow efficiency it is more important that there is always a resource available. (Modig & Åhlström 2013, 20-21)

#### *2.2.4.1 Little´s law and throughput time*

According to Little´s law there are two things which affect throughput time; number of flow units and cycle time. Prolonging the cycle time lengthens throughput time. Long cycle time can be caused by lack of speed while working or shortage of capacity. The law demonstrates that throughput time lengthens when number of flow units grows. Throughput time lengthens due to incomplete flow units. (Modig & Åhlström 2013, 36)

When comparing resource and flow efficiency, there is a paradox. In order to guarantee good resource efficiency, all the resources should utilized as well as possible. Preferably resources are used a hundred percent and in order to accomplish this, all resources should have work all the time. Flow unit buffer is needed, so that resources won´t need to wait for work. It is better that flow units are waiting for resources and not the other way around. The paradox here is that if flow unit buffer is created, the throughput time grows. (Modig & Åhlström 2013, 36)

#### *2.2.4.2 Law of bottlenecks*

Law of bottlenecks makes it easier to understand processes and what stands in the way of flow efficiency. There are several stops in the process and these create lines. These stops in the process are known as bottlenecks and lengthen the throughput time. (Modig & Åhlström 2013, 37)

### 2.2.5 Matrix of efficiency

In *This is Lean: Resolving the Efficiency Paradox* the efficiency matrix is introduced by Modig and Åhlström (2013, 100). It is based on resource and flow efficiency. In the matrix it can be seen how organizations can be categorized by two features: low or high resource efficiency and low or high flow efficiency (figure 2).

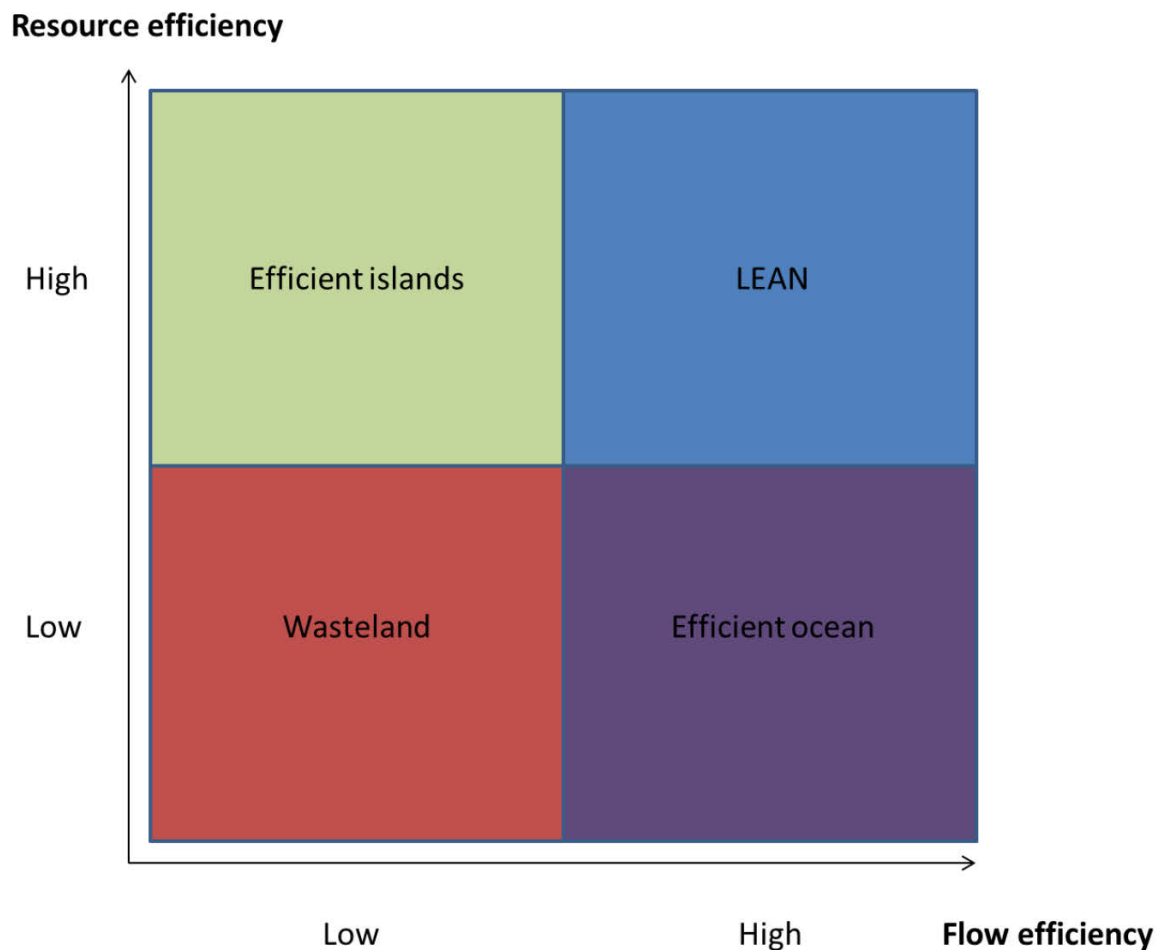


Figure 2. Efficiency matrix

From the efficiency matrix can be seen four places where organization can be located. These places are described in the table 10. (Modig & Åhlström 2013, 100)

TABLE 10. Description of places in efficiency matrix (Modig & Åhlström 2013, 101-102)

Efficient islands	<ul style="list-style-type: none"> <li>- Resource efficiency high</li> <li>- Flow efficiency low</li> <li>- Component or product is most of the time in storage</li> <li>- Undesirable waiting time.</li> </ul>
Efficient ocean	<ul style="list-style-type: none"> <li>- Flow efficiency high</li> <li>- Resource efficiency low</li> <li>- Primary stress on customer and fulfillment of needs.</li> </ul>
Wasteland	<ul style="list-style-type: none"> <li>- Resource efficiency low</li> <li>- Flow efficiency low</li> <li>- Resources used poorly</li> <li>- Flow is weak.</li> </ul>
Lean (The perfect state)	<ul style="list-style-type: none"> <li>- Resource efficiency high</li> <li>- Flow efficiency high</li> <li>- Hard to reach.</li> </ul>

### 2.2.6 Implementation of lean

Generally it is thought that lean is procedures and tools, but actually this is not the case. Lean is a strategy by which goals can be accomplished. Lean can be implemented through values, principles, methods and tools. (Modig & Åhlström 2013, 140-141)

Implementation of lean starts with standardizing company values, so that all the employees are on the same page where company is heading. Prioritizing and decision making principles need to be applied in order to reduce changes in process. Methods need to be standardized because this reduces variance in the process. Implementation of the tools also reduces changes in process. (Modig & Åhlström 2013, 142)

## 2.3 Enterprise Resource Planning systems

In the companies the role of information systems is constantly growing, when talking about data management and enterprise resource planning. Big or medium sized modern company cannot manage all the information without ERP. All the information

of a company is maintained by ERP. These are for example data management, planning and steering. (Haverila, Uusi-Rauva, Kouri & Miettinen 2005, 430)

The main idea for ERP is integration of data processing and enterprise resource planning. From the point of view of data processing this means that once certain information is entered, there is no need to enter it again. All the information can be seen by all the users. (Haverila etc. 2005, 430)

Integration basically means that company can manage all the resources, offices and plan business activities and production by using ERP. The functions of ERP are following: maintaining basic information, controlling events, company's data transfer, planning and maintaining, data collection of realization, producing documents and reporting and keeping statistics. (Haverila etc. 2005, 430)

These are the benefits of ERP by Haverila, Uusi-Rauva, Kouri & Miettinen (2005, 431)

- Data processing becomes more efficient
- Better planning of actions
- More efficient use of resources
- Faster reaction to events
- Faster data processing
- Better control of orders and deliveries
- Development of reports and key figures
- More efficient business management
- Better control of client database
- More efficient supply chain.

Disadvantages of ERP are price, complicated interface and deployment takes long time. More personalized interface is difficult to design and takes time. For just one single function interface might be too complicated to use. (Haverila etc. 2005, 431)

### 3 CURRENT STATE OF THE COMPANY

#### 3.1 Introduction to the current state of the company

The writer had some knowledge of how production planning was carried out from the employee's point of view. In addition to this she had some experience about resource scheduling for smaller team, which could be use as a basis of the study.

To get a bigger picture, I gathered more information from the state, tools and procedures by interviewing superiors. Interviews were implemented face to face according to the question form. Content of this question form is shown in appendix 1.

#### 3.2 Implementation of production planning

##### 3.2.1 Resource efficiency in Company X

Currently the company is mainly concentrating on resource efficiency, so that employees have something to do all the time. Company observes constantly the need for resources every month and corrects it if necessary for example by adding resources. Supervision of the resources is done by Traffic Coordinator, who follows use of resources on daily basis.

Need of resources is defined for a three month period before the scheduling for resources is done. The need is based on previous months and last year's need at the same time of the year. These numbers of resources are compared to estimation of revenue for each service and each month. Revenue is also estimated based on last year and last months. After estimations are reasonable and profitable, then the scheduling of the resources is done based on these estimations.

Naturally the estimations are not always accurate because there are many things which reflect on the need of resources. These are for example weather, events, out-bound runs out a call list, sick leaves and many other things which cannot be controlled. If the estimations are wrong, this will be seen in every day work for example lines become longer because of the lack of resources. On the other hand there might be too many resources and in this case people are twiddling one's thumbs. Neither of these cases is desirable and company is looking for solution to avoid both.

### 3.2.2 Flow efficiency in Company X

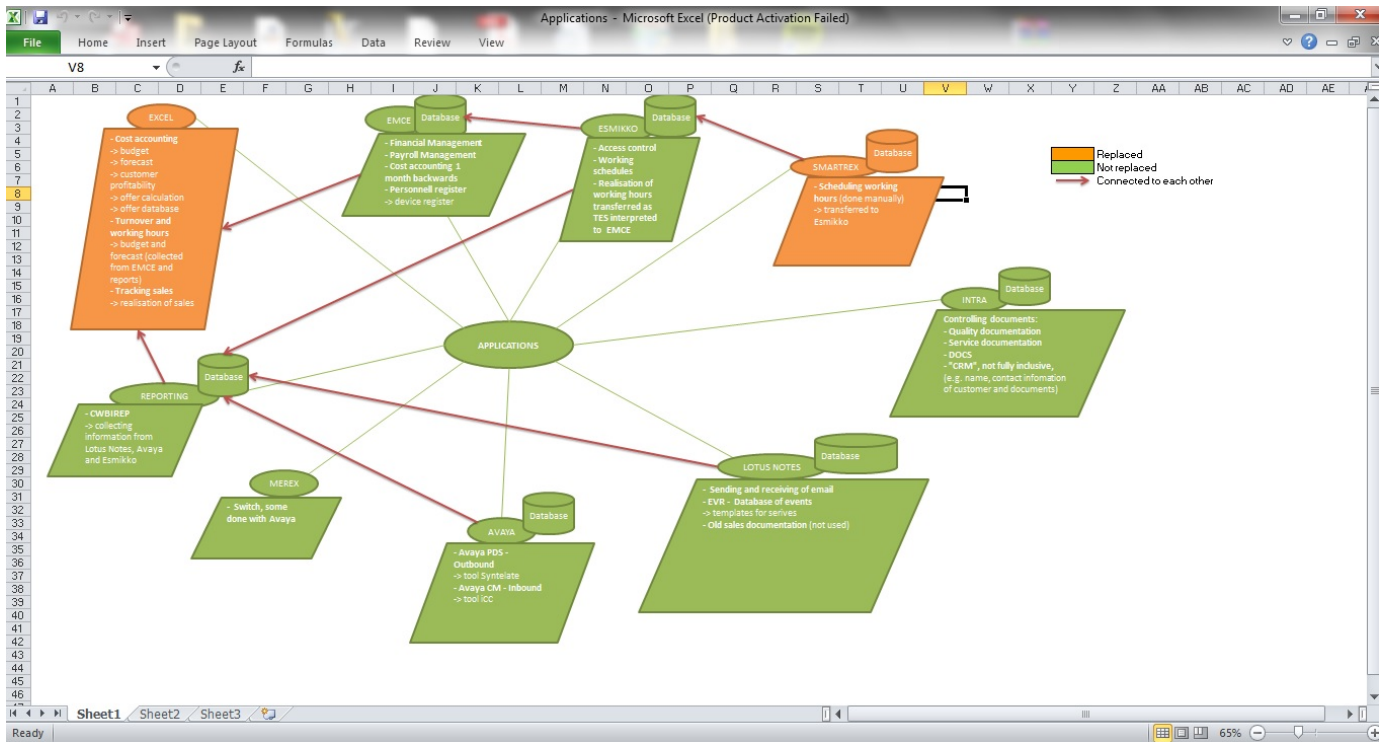
In the company flow efficiency is taken into account, because there are services which need quick response and have to be handled quickly. This has been one of the elements in resource planning, but even though how carefully you plan there are situations which cannot be predicted or affected.

Flow efficiency has not been the main aspect when planning the need of resources. So far it has been that resources are not waiting for the customer but customer rather waits for the service person. It is better that all the employees are working than waiting, considering the revenue.

An ideal case which company wishes to achieve is balance between resource and flow efficiency. Nevertheless this should not be achieved at the expense of the company's revenue. This becomes complicated because some of the services benefit from resource efficiency and from the flow efficiency.

### 3.3 Tools for enterprise resource planning so far

There are several tools used for enterprise resource planning which can be seen from mind map in Picture 1. All the applications are connected together somehow and ERP has been done by the help of these tools. It may be complicated and this is one of the reasons why some are planned to replace with one tool which could do everything easier.



PICTURE 1. Applications used for ERP

### 3.3.1 Emce

Emce is a financial management system. It contains payroll administration, cost calculations a month backwards, personnel register which includes employee's know-how, device register and TES interpretation. From Emce the TES interpretation and payroll administration are transferred to Esmikko.

### 3.3.2 Esmikko

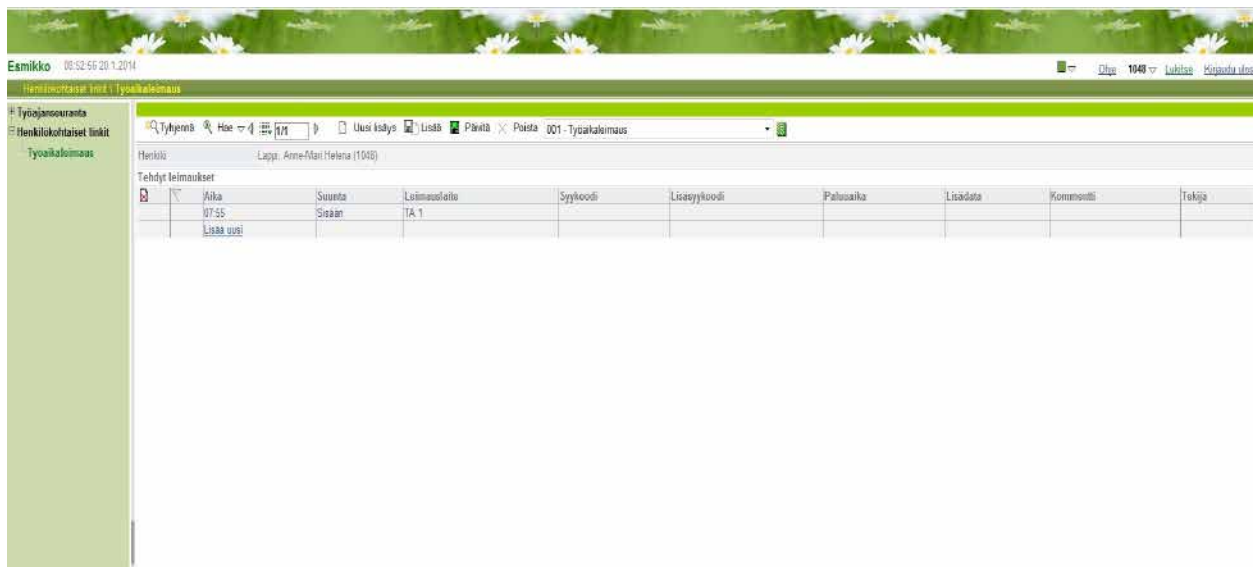
Esmikko is an access control system and it is the basis for payment of salaries. The system principle is following. Employee marks himself/herself to work, lunch break and out from office. The device can be seen from Picture 2. However in the evening, weekends and holidays, cost pool needs to be changed manually. Or if the tasks vary, cost pool must be changed manually by the employee. Picture 3 shows the internet site where the cost pool is changed.

Esmikko contains shifts and partial interpretation of shifts. Payroll information is transferred from Esmikko to Emce with TES interpretation done.





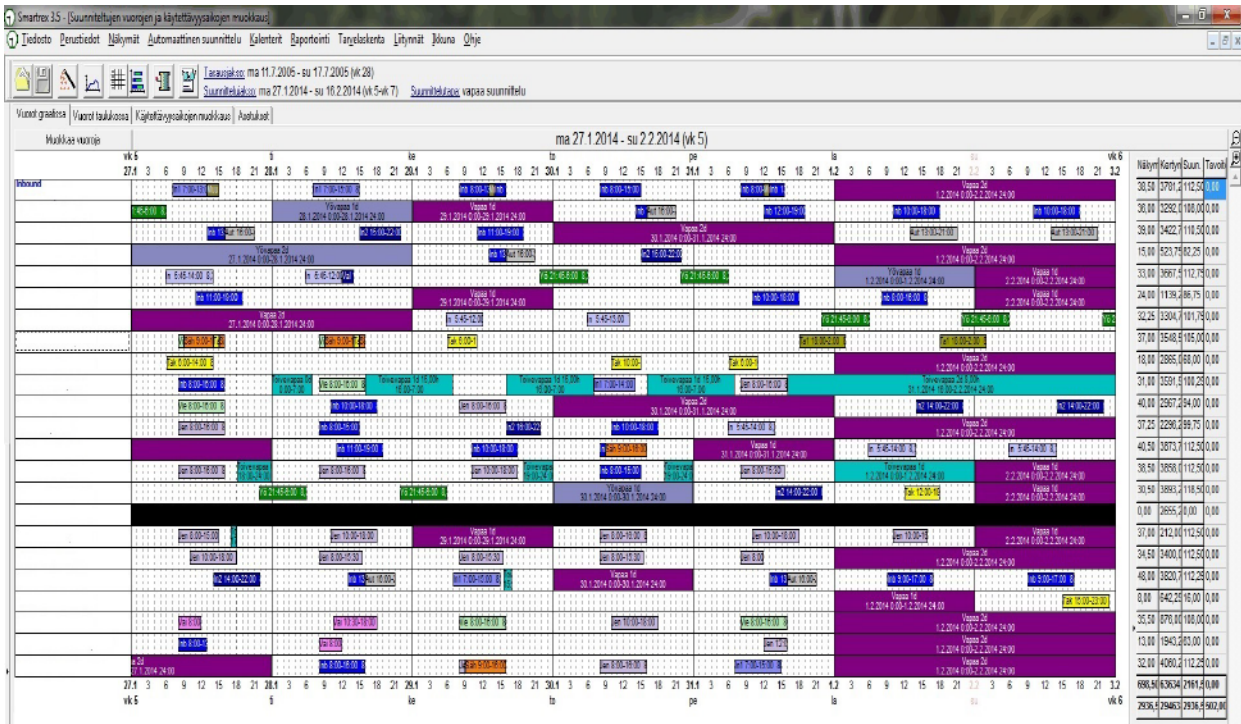
PICTURE 2. Device for monitoring working hours.



PICTURE 3. Esmikko web application for changing cost pool.

### 3.3.3 Smartrex

Smartrex is an application for scheduling. Scheduling is done manually by Traffic Coordinator. The scheduled shifts are transferred from Smartrex to Esmikko. The scheduling tool, Smartrex, is presented in picture 4. The time period of scheduling can be selected by the user and in the picture period is one week.



PICTURE 4. Resource scheduling tool, Smartrex

### 3.3.4 Intranet

Intranet is where all the company's documents are held, such as quality tables and documentation. In addition to these, intranet contains templates for documents, sales documents, contracts, commissioning, some of the customer documentation and creation of new documents.

Intranet includes also company's Customer Relationship Management, CRM, although it is quite narrow. It contains customer basic information such as; name, contact information, contact person and documents of the commission.

### 3.3.5 Lotus Notes

Lotus Notes is the tool by which company's email is sent and received. The event register, EVR, of the phone call is done through Lotus Notes. Also customer templates of commission and old sales documentation are found here.

### 3.3.6 Spreadsheet tables

Cost accounting and work hour estimation is done by using spreadsheet tables. This includes working hours, budget, prediction, profitability, offer calculation and offers. The revenue and resource estimations are kept in separate spreadsheet files. From picture 5 is seen the frame to the revenue estimation. The resource estimation is quite similar as the revenue calculation. Resource and revenue, estimated and actual, are gathered together and they are building the frame of the calculations are seen in picture 6.

In spreadsheet revenue and resources are predicted and actual values entered. This information was collected from Emce and reports.

Liikevaihtoennuste ryhmittäin tammi-joulukuu v.2013\_Varkaus+Savonlinna [Compatibility Mode] - Microsoft Excel (Product Activation Failed)

1	A		B	C	J	K	L	M	N	O	P	Q	R	S	T	U	V
1	ASIAKAS																
2	Asiakas numero	Asiakas	Ryhmä	Liikevaihto-ennuste	Liikevaihto-toteutunut	Liikevaihto-ennuste	Liikevaihto-toteutunut	Liikevaihto-ennuste	Liikevaihto-toteutunut	Liikevaihto-ennuste	Liikevaihto-toteutunut	Liikevaihto-ennuste	Liikevaihto-toteutunut	Liikevaihto-ennuste	Liikevaihto-toteutunut	Liikevaihto-ennuste	Liikevaihto-toteutunut
3				Tammikuu	Tammikuu	Helmikuu	Helmikuu	Maaliskuu	Maaliskuu	Huhtikuu	Huhtikuu	Toukokuu	Toukokuu	Kesäkuu	Kesäkuu	Heinäkuu	Heinäkuu
4		NYKYASIAKKAAT															
5																	
34	KOKO LIIKEVAIHTO €																
35	ENNUSTETTU/TOTEUTUNUT ERO € +/-																

PICTURE 5. Revenue, estimation and actual, template.

Tavoitetunnit tammi-joulukuu v.2013\_Varkaus + Savonlinna [Compatibility Mode] - Microsoft Excel (Product Activation Failed)

1	A	K	L	M	N	O	P	Q	R	S	T
1	ENNUSTETUT TUNNIT JA TOTEUTUNEET TUNNIT	TOUKOKUU TOTEUTUNUT	KESÄKUUN TAVOITE	KESÄKUUN TOTEUTUNUT	HEINÄKUUN TAVOITE	HEINÄKUUN TOTEUTUNUT	ELOKUUN TAVOITE	ELOKUUN TOTEUTUNUT	SYYSKUUN TAVOITE	SYYSKUUN TOTEUTUNUT	LOKAKUUN TAVOITE
2	IN										
3	TEKNISET TUKIP										
4	ESIMESTYÖ										
5	IN HALLINTO										
6	ENNUSTETUT TYÖTUNNIT YHTEENSÄ										
7	PALKKALLISET POISSAOLOT ( IN )										
8	ARKIPYHÄT ( huomoitu tunthinnessa										
9	SAIRAS										
10	ENNUSTETUT / TOTEUTUNEET TUNNIT YHTEENSÄ										
11	LEIKATTAVIA TUNTEJA (jos '+'merkinen ei leikattavaa jos '-'merkinen leikattavaa) ( HUOMIOITU VAIN TYÖTUNNIT)!!!										
12	LEIKATTAVIA TUNTEJA (jos '+'merkinen ei leikattavaa jos '-'merkinen leikattavaa) ( HUOMIOITU SAIRAS- JA MUUT POISSAOLOT)!!!										
13	PALKKAKUSTANNUKSET ENNUSTEEN MUKAAN										
14	ENNUSTEEN MUKAINEN HENKILÖSTÖKULU-% (TAVOITE 58 %)										
15	PALKKAKULUJEN JA LIIKEVAIHDON VERTAILU										
16	ENNUSTE/TOTEUTUNUT / KK	TOUKOKUU TOTEUTUNUT	KESÄKUUN TAVOITE	KESÄKUUN TOTEUTUNUT	HEINÄKUUN TAVOITE	HEINÄKUUN TOTEUTUNUT	ELOKUUN TAVOITE	ELOKUUN TOTEUTUNUT	SYYSKUUN TAVOITE	SYYSKUUN TOTEUTUNUT	LOKAKUUN TAVOITE
17	LIIKEVAIHTO ENNUSTE / TOTEUTUNUT										
18	PALKKAKUSTANNUKSET TAVOITE										
19	TUNTIKUSTANNUS										
20	TAVOITETUNNIT / TOTEUTUNEET TUNNIT										
21	TAVOITE HENKILÖSTÖKULUT KATE 1-% + TOTEUTUNUT										
22											
23	PALKKAKUSTANNUKSET LIIKAA /LIIKEVAIHTO										

PICTURE 6. Resource and revenue, estimated and actual, template.

### 3.4 Problems in Company X

The biggest problem and the reason why I began to do this research was to find a way how scheduling could be improved. The tools company has used so far were not as accurate and efficient as they should. Problems in scheduling cause problems in every day level and solution was needed as soon as possible. Bad scheduling caused overloading for employees when there was shortage in resources. Too many resources could also cause problems when employees were twiddling one's thumbs, which did not motivate people.

The interviews revealed another problem, which needs attention and this was company's values. Values of the company are following: customer is most important; we are professionals, we are glad to come to work, and profitable growth. These are very good values, but there are some troubles in realization from the employees point of view. Some did not quite underwrite all of the values.

Naturally there are some other things which need to be paid attention too, but there had to be a line and the study was executed from new points of scheduling and values. After studying the company, it was obvious that these were the critical problems which need studying.

## 4 RESULTS

### 4.1 Production efficiency

Motivation of an employee is critical when talking about production efficiency. Work in contact center is demanding and employees must be motivated and their work acknowledged. Results of production efficiency are presented from point of view of benchmarking and lean.

In the beginning the writer started to gather information of the company. Studied superiors in order to understand how the production is planned. Interviewed the employees to see their opinions. The information helped to understand the critical aspects which should study and use in benchmarking and lean. There were several aspects to consider and got ideas where study needs focus on.

After the interviews inside Company X, the writer started to search companies which are succeeded in their field of expertise. She received assistance for the search from Company X's Development Manager, Human Resources Manager and thesis supervisor, Jarmo Pyysalo. For the study she decided to choose only couple of companies from same area and a few from different areas of expertise. This way the results may vary more and give wider perspective for benchmarking.

Collecting data became very challenging, because some of the companies were not willing to share their knowledge and some declined to answer straight away. After calling and being rejected by several companies, I had one company's Manager to give me answers. This company was from different field of expertise and in small-scale compared to Company X. The company does not use any program for scheduling, because mostly the work is done in day shift. The results were different than I expected and in this case not what I was looking for. Results of the interview are presented in appendix 2.

During benchmarking phase it became clear that the competition is tough nowadays and companies are not willing to participate in benchmarking, although both companies could benefit from learning from each other. Analyzing the results was complicated because of the amount of received answers. This gave the idea to do benchmarking inside the company.



The benchmarking was made in small scale. 5 superiors, 5 employees from outbound and 5 employees from the inbound were interviewed. The results from the interviews were very valuable and gave a new perspective. Writer received wide range of answers as she collected information and results are presented in appendix 3. From the wide range of answers she discovered some opinions which came up several times. This feedback can be easily presented in columns (chart 1).

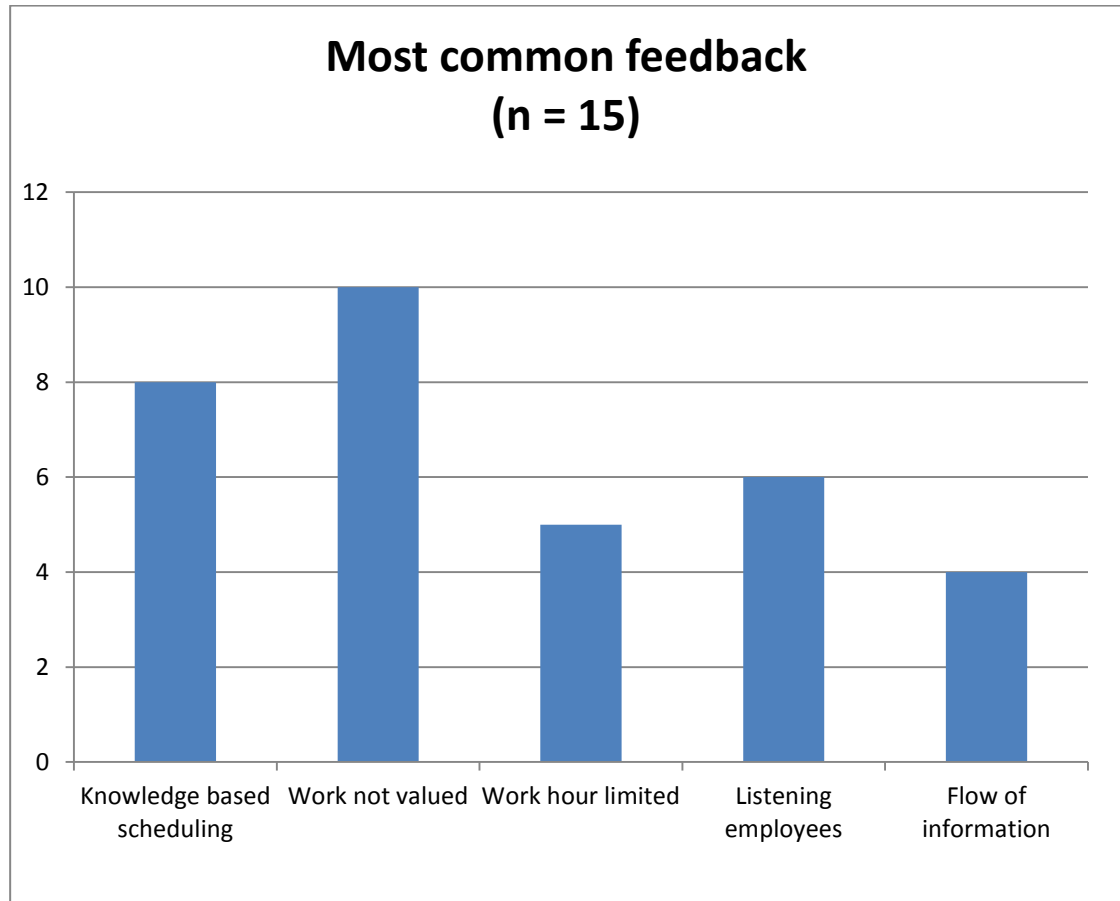


CHART 1. Most common feedbacks received from benchmarking inside the company.

The most common thing which is not paid enough attention to valuing work of the employees. Customers hardly give feedback and therefore in order to be motivated, employees need to get credit of their work. Equally important was knowledge based scheduling. Now Company X is going for the direction where everyone does everything. This is ideal if all the employees were perfect in everything they do.

In reality this is not realistic, because inevitably the quality of the service will suffer. There are projects and services which include a lot of information and it is not possible to give service defined in contract when employees are responsible for several services. Other things which affect work was that interviewees felt that they can't get

their voice heard, and problems in information flow. For the scheduling's point of view, the biggest problem was limited working hour. There are people who do only certain shifts and it makes work hour scheduling extremely complicated if there are several work hour limitations.

All these things affect production efficiency and after studying the company it was located in efficiency matrix (chapter 2.2.5). Company is located in between efficient islands and efficient ocean. This is caused by the resource scheduling problems and impossibility to predict the need of resources.

## 4.2 Resource scheduling

### 4.2.1 Comparison of ERP systems

In the beginning several companies which offer ERP systems were contacted and demos were tested. There were clear differences between some of the ERP systems and some had similar features (picture 7). This entire comparison is presented in appendix 4.

There are a few ERP programs which were out of the question: Lemonsoft, eVuoro and Value Frame. Lemonsoft could not meet Company X's needs. The integration of the programs which Company X needs was not possible. eVuoro can be modified for customers but in order to meet Company X's needs, it would take a long time until it would be useful. Value Frame seemed to be very good program, but it was not focused enough on resource scheduling.

The most promising ERP programs were Procomp Aikajana, Numeron and Tiima. These three programs had the ability to fulfill Company X's needs.



	A	B	C	D	E	F	G
1		Value Frame	Lemonsoft	eVuoro	ProComp aikajana	Numeron	Tiima
2	Work hour scheduling in 15 minutes accuracy			x	x	x	x
3	Work shifts according to project Automatic fill			x	x	x	x
4	(knowhow considered)				x	x	x
5	Customerships	x	x				
6	Offer	x	x				
7	Work hours - planned	x	x	x	x	x	x
8	Work hours - actualized	x	x	x	x	x	x
9	Work schedules		x		x	x	x
10	Resources	x	x		x	x	x
11	Revenue forecast	x	x				
12	Revenue actualized	x	x				
13	Integration to Esmikko				x	x	x
14	Integration to Emce				x	x	x
15	Easy to use	x	x	x	x	x	x
16	Reports to excel	x	x		x	x	
17	Gantt chart			x	No, if time frame too long (2 weeks)	x	x
18	Mobile interface	x	x		x		x
19	Browser based	x	Possible to use internet (extranet)	x	x	x	x
20							

PICTURE 7. Comparison of the ERP systems.

#### 4.2.2 Spreadsheet as a tool

The writer was asked to improve the existing spreadsheet which has been used so far to forecast working hours and revenue. Improving the existing spreadsheet was quite challenging because there were so many things which needed to include. Spreadsheet needed to include gross margin and Gantt chart in addition to working hours and revenue data (picture 8).

		2011	2012	2013	Liikevaihto-ennuste	Liikevaihto-toteutunut	Liikevaihto-ennuste	Liikevaihto-toteutunut	Liikevaihto-ennuste	Liikevaihto-toteutunut	Liikevaihto-ennuste	Liikevaihto-toteutunut	Liikevaihto-ennuste
		Yht (tot.)	Yht (tot.)	Yht (tot.)	TAMMI	HELMI	MAALIS	HUHTI					
4	<b>1.0 IN</b>												
33	KOKO LIKEVAIHTO €	0	0	856835,9	768767	0	67678	0	67687	0	55634	0	3
34	EROTUS	0	0	-685397,1	-768767		-67678		-67687		-55634		
35	<b>2.0 VAIHDE</b>												
42	KOKO LIKEVAIHTO €	0	0	110406,36	0	0	0	0	0	0	0	0	0
43	EROTUS	0	0	-79363,64	0		0		0		0		
44	<b>3.0 BO</b>												
49	KOKO LIKEVAIHTO €	0	0	113601,72	0	0	0	0	0	0	0	0	0
50	EROTUS	0	0	-61498,28	0		0		0		0		
51	<b>4.0 TEKNISET TUKIPALVELUT</b>												
55	KOKO LIKEVAIHTO €	0	0	108341,74	0	0	0	0	0	0	0	0	0
56	EROTUS	0	0	-55658,26	0		0		0		0		
57	<b>5.0 OUT</b>												
70	KOKO LIKEVAIHTO €	0	0	680815,71	0	0	0	0	0	0	0	0	0
71	EROTUS	0	0	-603324,3	0		0		0		0		
72	<b>6.0 OUT</b>												
84	KOKO LIKEVAIHTO €	0	0	661170,65	0	0	0	0	0	0	0	0	0
85	EROTUS	0	0	-220686,2	0		0		0		0		
86	<b>7.0 OUT</b>												

PICTURE 8. Forecast and realized revenue (numbers imaginary).

After all the needed information was added to the spreadsheet, it became clear how complicated it is to use this tool as ERP. There is too much information which needs to be inserted manually and therefore a big risk for human error. Perhaps this tool could be used as a side tool, but not as an actual tool to control production efficiency.

## 5 CONCLUSIONS

During the study it became clear that there is not a simple solution for the problem areas of the company. Every company needs to constantly improve their work in order to be better. Developing needs work and Company X should continue benchmarking inside the company further.

Company X should gather a team which would continue improving the development of the company. The group should go through current values; customer is most important; we are professionals, we are glad to come to work and profitable growth; and re-evaluate if there is something else to aim for. They should concentrate on the values of the company and find out a way how to achieve these values. When finding the measures how to achieve values, Company X can get resource and flow efficiency better.

So far the Company X is focused more on resource efficiency, but company should focus on core competence in order to increase flow efficiency. Core competence means that service which needs more focused knowledge should have its own experts. In this way the flow of production would be smoother, faster and the quality of the work would increase. The results of interviews show that Company X should put the quality of the work and flow efficiency to higher priority.

Resource efficiency is equally important and at this moment resource efficiency is not good enough. In order to achieve better resource efficiency, Company X should use proper ERP program instead of spreadsheet. Current spreadsheet tool is not agile and there is higher risk for human error. Company X has approximately 130 employees and company this big should invest in ERP program.

In results it can be seen, three ERP programs are most suitable for Company X's purposes. Company X's Traffic Coordinator, who is in charge of scheduling, should test these three programs. Traffic Coordinator has the knowledge and experience that needs to be taken into account in ERP program. When the testing is over, it is easy to tell which one of the programs is most suitable and in an acceptable price range.

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Interview results of the superiors (Confidential)

## Benchmarking results outside of the Company X

For my thesis I make research of the companies which make projects. I would like ask few questions concerning your company's production management.

- 1) How many employees does your company have?
- 2) What kind of projects does your company do?
- 3) How is scheduling and phasing of the project carried out?
- 4) Describe typical bottlenecks which are detected during planning of the project?
- 5) How are these bottlenecks taken into account? How have you prevented these?
- 6) Is employee's versatility taken into account when scheduling the project? How is this carried out?
- 7) Does your company use a certain tool for scheduling? For example MS Excel or MS Project?
- 8) How is scheduling carried out in your company?

### Answers:

- 1) Entirely 31 employees from which 23 employees in production
- 2) Net walls, cover walls, soundproof walls manufacturer
- 3) First 3D model-> sales-> 3D design-> manufacturing
- 4) Depends from load, traffic in designing or in production
- 5) External help for designing and more employees for production
- 6) Well. All workers can do everything
- 7) Excel, Outlook
- 8) Mainly day shift

Benchmarking results inside the Company X (Confidential)

## Comparison of ERP programs

	Value Frame	Lemonsoft	eVuoro	ProComp aikajana	Numeron	Tiima
Work hour scheduling in 15 minutes accuracy			x	x	x	x
Work shifts according to project Automatic fill (knowhow considered)			x	x	x	x
Customerships	x	x		x	x	x
Offer	x	x				
Work hours - planned	x	x	x	x	x	x
Work hours - actualized	x	x	x	x	x	x
Work schedules		x		x	x	x
Resources	x	x		x	x	x
Revenue forecast	x	x				
Revenue actualized	x	x				
Integration to Esmikko				x	x	x
Integration to Emce				x	x	x
Easy to use	x	x	x	x	x	x
Reports to excel	x	x		x	x	
Gantt chart			x	No, if time frame too long (2 weeks)	x	x
Mobile interface	x	x		x		x
Browser based	x	Possible to use internet (extranet)	x	x	x	x
Other		CRM not working, no integration to Lotus Notes	Does not meet the needs as it is.	Employees can fill requests for free time	Home page can be changed as needed	Work shift request can be filled through internet.
		Calendar can be synchronized with Outlook.	Program is developed and could be useful but only in long run.	Employees can see work shifts through internet. In case of illness, shift can be seen by everyone or put to someone.		
		Lemonsoft announced that cannot fulfill needs.				