

Bishal Bhandari

DEVELOPMENT OF REAL-TIME VISUALIZATION AND CONTROLLING OF RDI TASKS BY LEAN

Case study of Centria wood laboratory, Ylivieska

Thesis

CENTRIA UNIVERSITY OF APPLIED SCIENCES

Industrial Management

April 2020

ABSTRACT

Centria University of Applied Sciences	Date April 2020	Author Bishal Bhandari
Degree programme Industrial Management		
Name of thesis DEVELOPMENT OF REAL-TIME VISUALIZATION AND CONTROLLING OF RDI TASKS BY LEAN. Case study of Centria wood laboratory, Ylivieska.		
Instructor Elisa Saarela		Pages 53 + 3
Supervisor Sakari Kinnunen		
<p>This thesis is based on the research project, which was carried out in Centria wood laboratory, Ylivieska. The primary goal of the research project was to develop a real time visualization system in order to control and monitor the Research Development and Innovation tasks in the multi project environment of Centria wood laboratory by using a popular tool of Lean management method i.e. Kanban board.</p> <p>The Centria wood laboratory is run under the RDI unit of Centria University of Applied Sciences which has been conducting more than a hundred of projects every year in various fields. In the absence of an efficient visualizing tool, it was quite challenging to keep track of the situation of different tasks in multi-project environment. Thus, this research project was aimed to find better ways to control projects and tasks visually with a coherent picture by using a new Kanban board which was used to control the flow of tasks on the basis of pull technique. Lean was introduced already in 2015 in the Centria wood laboratory, but this report will explain why lean journey was adopted thoroughly as a part of organizational culture in Centria wood laboratory. In addition, it will also describe why Kanban tool was selected to overcome the problem prevalent in Centria wood laboratory. This report will also provide more ideas about the development phases of the new Kanban board. Furthermore, on the basis of Kanban principle this report has suggested that Kanban journey is a continuous process which will never be complete, but it needs to be improvised according to the need and flow of the time.</p> <p>During the research process, all the knowledge, which was gained during lectures, practical tasks related to different subjects, information gained from several articles, research journals and books as well as guidelines from seniors and colleagues were adapted in order to prepare this report. Moreover, interviews are regarded as one of the powerful tools to investigate issues in depth which will help to analyze and forecast the current and future situation of any subject. Thus, a real interview was carried out among the employees in order to explore of Centria wood laboratory in detail.</p> <p>As a result of this project, Centria wood laboratory was able to continue its lean journey based on the principle of continuous improvement. The development and implementation of the new Kanban board has enabled employees of Centria wood laboratory the real time development and visualization of RDI tasks in the multi project environment. Last but not least, this research project has also assisted in achieving the desired objectives set by the Centria wood laboratory.</p>		
Key words Centria University of Applied Sciences (UAS), Centria wood laboratory, Development and Innovation (RDI), Kaizen, Kanban, Lean, Research, Toyota Production System (TPS), Value Stream Mapping (VSM), Work in Progress (WIP).		

CONCEPT DEFINITIONS

Baseline	The baseline is used to measure how performance deviates from the plan.
Bottleneck	The part of the process which limits the actual capacity of the whole process.
Bottom line	Final amount of money or net profit.
CE marking	Certification mark which is used to confirm that the given product is under EU directives regarding health, safety and environment protection.
DL	Deadline
Heijunka	A technique of levelling or smoothing production.
INGO	International non-governmental organizations
Inventory	The stock of an item
JIT	Just in Time
Kaizen	A Japanese term which emphasizes for good changes via continuous improvement.
Kanban	A Japanese term which is used for the pull production by using visual signal.
Lead time	It is the time between the starting point of the process to the delivery to its end customer.
Muda	Japanese term for waste
NVA	Non-Value Added is any steps or process which is neither adding nor creating value to the product and customer.
OEE	Overall Equipment Effectiveness
RDI	Research, Development and Innovation
Revenue	The total value of goods or services, the total income received from a given source.
SMED	Single Minute Exchange of Dies is one of lean tools which is used to reduce setup time from a process.
SWOT	SWOT is a strategic planning technique to identify strengths, weaknesses, opportunities and threats of a person or business organization.
TPM	Total Productive Maintenance is an approach of increasing the productivity, efficiency and safety of the process.

TPS	Toyota Production System
Turnover	The total amount of money made by a firm by trading goods or services in a given period of time.
UAS	University of Applied Sciences
VA	Value Added is an activity which will add value to the product or service and customer is willing to pay for it.
VSM	Value Stream Mapping is a lean management method to analyze the current state and design future state in order to enhance lead time.
WIP	Work in Progress refers to partially finished goods waiting for further process.

FOREWORDS

First of all, I would like to provide special thanks to my respected teachers Kaija Arhio and Marja-Liisa Kaakko who acted as bridge to connect me with Centria RDI team. I would like to express my sincere gratitude to my instructor Elisa Saarela and the entire RDI team of Centria wood laboratory for trusting me in this research project. I am heartily thankful to my thesis supervisor, Sakari Kinnunen for all the valuable suggestions provided to me during my thesis process. I also want to appreciate my teacher Timo Taari for all the technical assistance to make this thesis complete. Additionally, I am highly obliged to my English teacher, Ulla Orjala for adding taste to my sentences.

At the end, I would also like to remember my family members, lecturers and my colleagues for all the assistance and valuable advice to make this thesis written. Last but not least, I would like to provide special package thanks to everyone who puts their hands together directly or indirectly for the completion of this thesis.

ABSTRACT
CONCEPT DEFINITIONS
FOREWORDS
CONTENTS

1 INTRODUCTION.....	1
2 EXPLORING CENTRIA	3
2.1 Introducing Centria UAS.....	3
2.2 Organizational Structure of Centria UAS	4
2.3 Centria Research Development and Innovation	5
2.4 RDI Organizational Structure of Centria	7
2.5 Examples of ongoing and completed projects by Centria RDI	8
3 GLANCE AT LEAN	10
3.1 History of Lean.....	10
3.2 What is lean manufacturing?	11
3.3 Why Lean manufacturing?.....	11
4 LEAN PRINCIPLES.....	13
4.1 Defining Value.....	14
4.2 Value Stream Mapping (VSM)	14
4.3 Create Flow	14
4.4 Establish Pull.....	15
4.5 Pursue Perfection:.....	15
5 FOURTEEN LEAN TOOLS	16
5.1 Value stream mapping (VSM)	16
5.2 Takt time	16
5.3 Kaizen.....	16
5.4 Jidoka	17
5.5 Five S (5S).....	17
5.6 Single Minute Exchange of Dies (SMED).....	17
5.7 Poka-Yoka	18
5.8 Five whys (5W).....	18
5.9 Standard work	18
5.10 Total Productive Maintenances (TPM).....	18
5.11 Cellular Manufacturing	19
5.12 Heijunka.....	19
5.13 Just-In-Time (JIT)	19
5.14 Kanban	19
6 TYPES OF WASTES.....	20
6.1 Over production.....	20
6.2 Defects	20
6.3 Over-processing	21
6.4 Skills	21
6.5 Waiting.....	21
6.6 Transportation	21
6.7 Motion	22

6.8 Excess inventory	22
6.9 Behavior	22
7 INTRODUCING CENTRIA WOOD LABORATORY.....	23
8 BACKGROUND OF THE TASK	25
9 DEVELOPMENT PHASES	28
10 KANBAN BOARD	30
11 THE KANBAN PRINCIPLES	32
11.1 Visualize work	32
11.2 Limit the work in Progress (WIP)	32
11.3 Manage flow of work	33
11.4 Make process explicit	33
11.5 Continuous improvement	33
12 THE KANBAN VALUES.....	34
12.1 Transparency	34
12.2 Balance	34
12.3 Customer Focus.....	34
12.4 Workflow.....	35
12.5 Leadership.....	35
12.6 Understanding.....	35
12.7 Agreement	35
12.8 Respect.....	36
12.9 Collaboration.....	36
13 BUILDING A NEW KANBAN BOARD	37
13.1 Kanban board Version 1.....	40
13.2 Drawback of Kanban board Version 1	41
13.3 Kanban board Version 2.....	41
13.4 Kanban board Version 3.....	42
14 RECOMMENDATIONS.....	47
14 CONCLUSION.....	50
REFERENCES.....	51
APPENDICES	
FIGURES	
FIGURE 1. Organizational structure of Centria UAS	5
FIGURE 2. Organizational structure of Centria RDI	7
FIGURE 3. Lean Manufacturing	12
FIGURE 4. Five principles of Lean	13
FIGURE 5. Organizational structure of Centria wood laboratory.....	23

PICTURES

PICTURE 1. Operational Area of Centria UAS.....	4
PICTURE 2. One of the problems of Centria wood-laboratory.....	26
PICTURE 3. Practicing 5S by marking lines on the floor	29
PICTURE 4. Early Kanban board used in Toyota.....	30
PICTURE 5. Basic Kanban concept	31
PICTURE 6. The Old Kanban board	37
PICTURE 7. Proposed idea of new Kanban board.....	38
PICTURE 8. Version 1 of new Kanban board	40
PICTURE 9. Version 2 of the new Kanban board.....	42
PICTURE 10. Division of works.....	44
PICTURE 11. Evaluations of actions	45
PICTURE 12. Kanban board Version 3.....	46
PICTURE 13. What is mission and vision.....	47

TABLES

TABLE 1. Examples of ongoing and completed projects by Centria RDI.....	9
TABLE 2. Five S (5S).....	17
TABLE 3. Example of priority calculator.....	41

1 INTRODUCTION

According to Polytechnic Act (932/2014), Research Development and Innovation (RDI) activities are taken as a crucial factor to boost Finnish Innovation System. In order to lead Finnish Innovation to the next level, Finnish government has decided to lead pedagogical and RDI activities parallelly. At present, there are 13 universities and 22 universities of applied sciences operated under the Ministry of Education and Culture's administrative branch of Finland. Though, Universities of Applied Sciences (UAS) are operated under the supervision of administrative branch of the Ministry of Education and Culture's as public limited companies but they have the right to pass legal entities and orders independently based on their internal administration. Additionally, there are two other universities of applied sciences, Åland University of Applied Sciences and Police University College, which are operated under the mandate of the Ministry of the Interior. (Ministry of Education and Culture.)

In Finland, universities are designed to focus on scientific research and education based on its curriculum whereas Universities of Applied Sciences emphasize on offering practical based education focusing working life via research development innovative and artistic activities. The main motto of UAS is to provide practical based quality education based on working life, promoting regional development and enhancing industrial structure of the region. Additionally, it also cooperates with municipalities and the regional council being part of Finnish University association in order to conduct academic activities with the regions which do not have their own university. (Ministry of Education and Culture.)

The mission of University of Applied Sciences is to provide higher education to prepare its students for the professionally expert jobs and the education is based on the requirements of working life. Moreover, via polytechnic education the UAS should focus on the professional development of individual in the related field through applied research, development and innovation activities. This will support practical based university education which will contribute for the promotion of working life and regional development by altering industrial structure of the region. To sum up, sustainable learning and versatile development will be the primary concerns of the UAS while carrying out their mission. (University of Applied Sciences Act 9.5.2003/351.)

In Finland, Universities of applied sciences fall under of the Finnish higher education system which are governed by the Ministry of Education and Culture sector. Since 1995 Centria University of Applied Sciences provides higher education based on the requirements of working life in order to support and

foster development activities in the central and northern Ostrobothnia region. Additionally, it is also responsible for conducting applied research development and innovation activities in the polytechnic zone of Kokkola, Pietarsaari and Ylivieska. (Centria UAS.)

The topic of this thesis is real time visualization of the RDI tasks in Centria UAS by applying lean method. Thus, the goal of the thesis was to develop a new Kanban board in order to visualize RDI activities in Centria UAS in an effective and efficient way by using lean management. In general, Kanban board is a visual board with sticky notes. These sticky notes help to communicate about status, progress and issues related to the task. It is one of the crucial lean tools which follow pull techniques in order to optimize the flow of tasks without any hindrance.

Basically, the thesis is divided into two parts, i.e. theoretical and practical part. In the theoretical part, I have tried to explore Centria UAS starting from its history to its current state. I also discuss RDI culture in Centria and how projects are managed and carried out. Additionally, I provide detailed information about the history, tools, principles and advantages of lean management.

The practical part of the thesis was based on my research activities which were conducted in Centria wood lab which operates under Centria RDI department. During my research period, I put my effort to make a detailed study of Centria wood laboratory in order to find an effective way to implement lean thoroughly as an organizational culture. There is a saying that a picture speaks more than a thousand words so I developed a new Kanban board which will help to visualize ongoing tasks in Centria wood laboratory. Last but not least, I also identified bottlenecks prevalent in Centria wood laboratory and recommended solutions for them.

To sum up, this thesis will help to visualize the ongoing RDI tasks in Centria wood laboratory clearly and assist the continuous flow of the tasks without any interruption. Furthermore, this thesis can be used as reference to discover more about Centria UAS, lean manufacturing and implementation of Kanban board.

2 EXPLORING CENTRIA

2.1 Introducing Centria UAS

Centria University of Applied Sciences is a private owned higher degree institution situated in Western Finland. In 1991, the government provided a short-term temporary license to Kokkola Polytechnic as an experimental project. After a year, the polytechnic started its educational journey from the field of technology, business and administration as well as in health care. Later in 1995, the experimental polytechnic was expanded to Ylivieska, Pietarsaari and Haapajärvi Education was started to commence in Finnish and Swedish language. Additionally, social studies were also included in the curriculum. (Keski-Pohjanmaan ammattikorkeakoulu 2002, 8.)

Gradually, the polytechnic was developed into a multidisciplinary polytechnic by providing innovative, nourishing and multicultural environment to its students and staffs. As a result, on 1st August 1998, Central Ostrobothnia Polytechnic was granted with a permanent license. Later, The Ministry of Education expanded the course selection with music (1999), humanities and education (2000) and tourism (2001) as a separate degree program. Today, the polytechnic is renowned with the name of Centria University of Applied Sciences which is derived from Central Ostrobothnia UAS which came in act in the autumn semester of 2012. (Keski-Pohjanmaan ammattikorkeakoulu 2002, 8.)

At the moment, Centria UAS is owned by stakeholders from a limited liability company. Central Ostrobothnia Education Group, City of Kokkola, Pietarsaari and Ylivieska, Kalajoki Municipal Education and Training, the Ostrobothnia Chamber of Commerce, Central Ostrobothnia Entrepreneurs Association, Consortium, Raudaskylän Christian College Association, Central Ostrobothnia Conservatory Support Association are the shareholders of Centria UAS. Among all, the City of Kokkola is the biggest shareholder with 27 % of shares. Today, Centria UAS is proceeding on the path of internationalization with the slogan of 'A University with a big heart' by creating safe, responsible, innovative, nourishing and multicultural environment. Currently, Kari Ristimäki is the Managing Director (Rector) of Centria UAS. During the year 2018, the annual turnover of Centria was 24.6 Million Euros. At present, Centria has 23 degree programs in 5 different fields: Technology, Business Management, Health Care & Social Service, Culture and Humanities & Education from three location picture 1: Kokkola, Ylivieska and Pietarsaari enrolling 2900 students and 250 employees. (Centria UAS; Issuu 2016.)



PICTURE 1. Operational Area of Centria UAS (adapted from Centria UAS)

2.2 Organizational Structure of Centria UAS

Centria is a limited liability organization. On the top, its all affairs are governed by Limited Liability Company Act 624/2006, UAS Act 932/2014, VNA Government Regulations 1129/2014 and other Legislation Act. Under them, there is the ministry of Education and Culture, that acts above Articles of Association, Service Regulations and Polytechnic Instructions.

At present, rector Kari Ristimäki acts as the managing director (CEO) of Centria UAS who is also responsible for the management of the limited liability company. Ristimäki is also connected with Service Regulation, Auditing, and Employer-employee group via general meetings. Similarly, there is Stina Mattila, who is acting as the chairman of the Centria government. Last but not least, under the supervision of Pekka Hulkko Centria Teaching, RDI and Internal Service of University are being governed. Moreover, figure 1 explains the organizational structure of Centria UAS. (Centria UAS.)

Toimitusjohtaja, rehtoriin päätös 14.1.2019

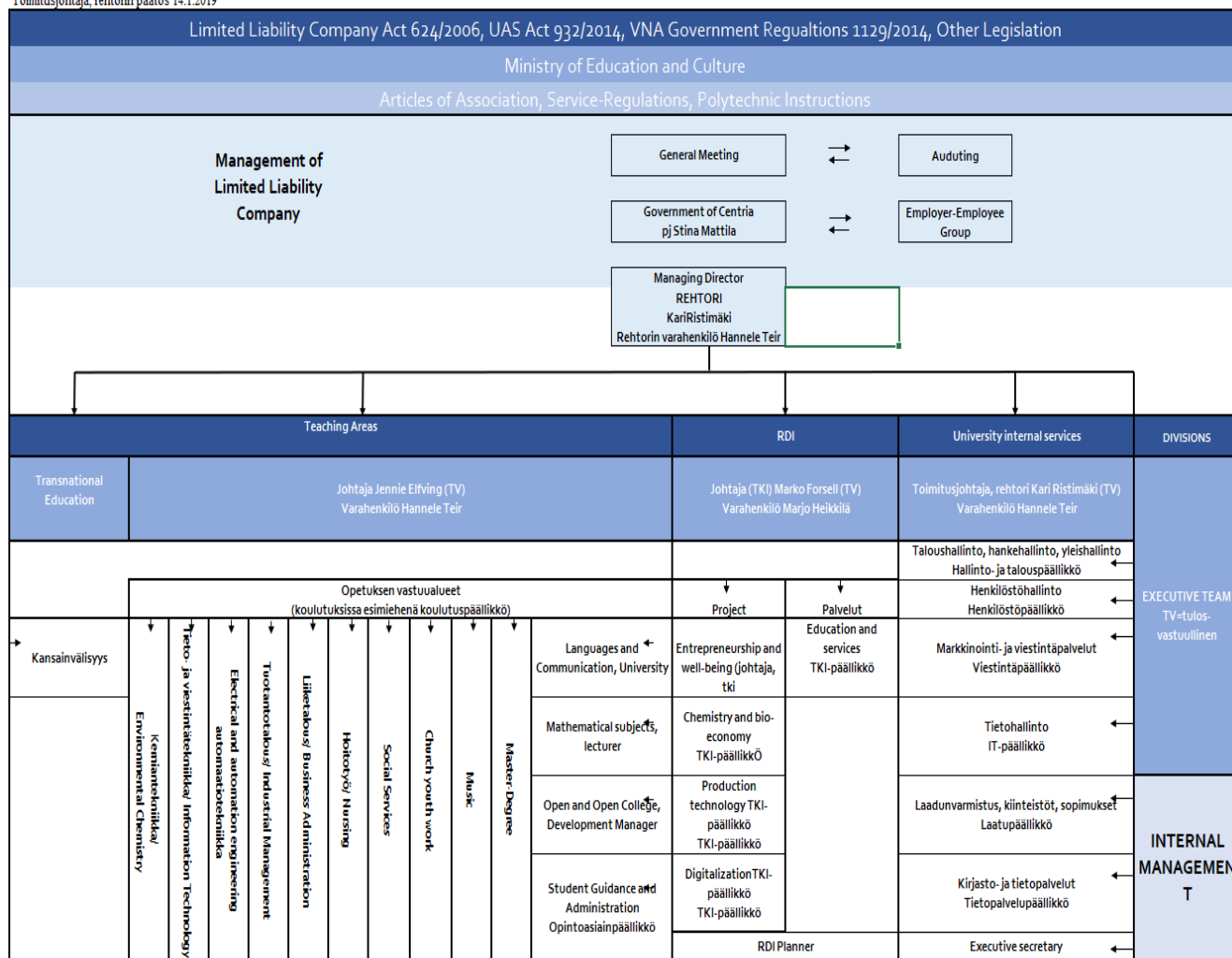


FIGURE 1. Organizational structure of Centria UAS (adapted from Centria UAS)

2.3 Centria Research Development and Innovation

In this competitive era of science and technology, the prime goal of every company is to create innovative ideas. Every competitive advantage has a limited life span so most of the reputed companies invest a large amount of money in the research, development and innovation. They are working continuously in order to introduce new products and services which can be added as valuable assets in the company's bottom line.

Apart from education, Centria UAS has a long experience of managing, funding and leading publicly funded research, development and innovative projects. Every year Centria carries out more than 100 Research Development and Innovation (RDI) activities. During 2018, the total volume of RDI activities

was 8.6 million Euros employing 105 people under the RDI unit. Highly skilled project managers from Centria RDI manage funding channels from regional, national and international level donors. On the basis of their knowledge and experience they lead different projects by analyzing the administrative requirements of each donor. (TKI Centria UAS.)

Today, Centria RDI unit carries out development-oriented research activities in two ways: either on request from its business customers (company/organization) or as experimental project in the request of donor. The prime goal of Centria RDI unit is to facilitate continuous development of local areas by improving local influence which will assist to improve the quality of goods and services minimizing lead time. It also aims to provide up-to-date education and learning to its students. Moreover, it also serves local businesses and industry by improving the competitiveness of the enterprises and organizations. Thus, it is also regarded as the top unit of the regional development by the Ministry of Education. (Keski-Pohjanmaan ammattikorkeakoulu 2002, 46.)

In Centria, RDI activities are pragmatic, sustainable and development oriented. They are carried out by a group of research and development experts, teachers and students. The main motto of RDI projects of Centria is to yield qualified manpower who can foster innovative ideas and technologies by boosting the productive activities and competitiveness of local companies and organizations. Today, Centria RDI unit focuses on following issues:

- Chemistry and bioeconomic (Biomass and high-value material, New materials, Renewable energy, Chemical analysis, Circular economy)
- Production technology (Smart production, robotics reverse engineering and 3D printing, Quality, Lean and data analysis, Wood and building product technology and surface treatment, Pro-active maintenance and welding restoration, Sustainable development and serialization)
- Digitalization (Gaming technologies, AR and VR, Information security, The data network of the future, Software and hardware solutions)
- Entrepreneurship and well-being (Supporting entrepreneurship, fostering business, promoting welfare, Development of pedagogy and enhancing learning) (TKI Centria UAS.)

In Centria, RDI activities are closely linked with the teaching learning activities which enables Centria students to develop new skills and techniques practically via real time working life. Through RDI projects students are supplied with internships, thesis topics, project jobs and work placements. Addition-

ally, RDI activities in Centria also act as medium to connect its student globally via studies and internships. Students in Centria have opportunities to collaborate and prove themselves by giving their best in the following tasks:

- Project Service
- Research activities
- Product or process development projects
- Project preparation, finding appropriate financing channels and project management
- Expert Services
- Laboratory and testing services
- Wellness Services
- Training Session. (TKI Centria UAS.)

2.4 RDI Organizational Structure of Centria

In Centria, RDI activities are governed by the board. This board is responsible for designing and assigning RDI activities in a sustainable manner in order to tackle all those possible obstacles tactfully which might occur in the middle of the project. At present, Marko Forsell acts as the director of Centria RDI. Under his supervision there are five managers who manages different project activities and services in their own fields: Entrepreneurship and Well-being, Chemistry and Bioeconomy, Production Technology, Digitalization and Entrepreneurial Service activities. Moreover, figure 2 explains more about organizational structure of Centria RDI.

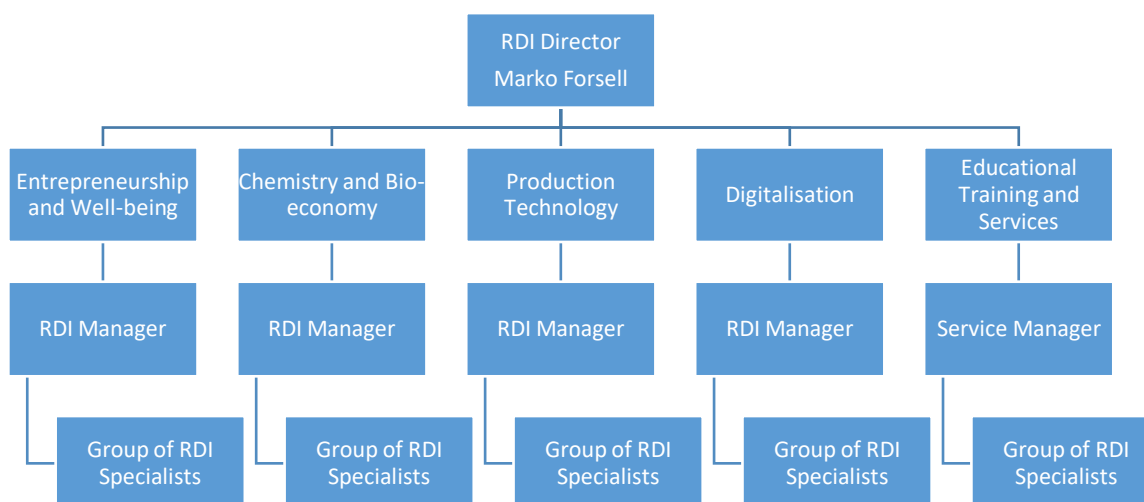


FIGURE 2. Organizational structure of Centria RDI (adapted from TKI Centria)

2.5 Examples of ongoing and completed projects by Centria RDI

Centria RDI has a long experience in leading and partnering research activities nationally and internationally. Today, it conducts various research project in five areas co-operating with national and international partners. Business Finland, ELY Centres, Regional Council and the European Union are main sources of funding for the RDI activities of Centria UAS. Centria has signed an agreement with more than 100 partner institutions around the globe. Centria has national and international donors for different projects. In 2017, the total volume of Centria RDI was 8.3 M€, of which 7.1 M€ was funded by parties outside Finland. Conducting RDI activities with international parties is an opportunity to learn new things as well as to be introduced in global market. On the other hand, there are also some difficulties due to the variation in acts and laws while coordinating with international partners.

Local business communities are also closely involved in planning, implementation and financing different project activities for the versatile development of Ostrobothnia region but most of the RDI activities of Centria are funded by international donors. It is more convenient to commence a project funded by national donors due to flexible and familiar laws and acts. The following table 1 will give examples of the ongoing and completed projects by Centria RDI.

TABLE 1. Examples of the ongoing and completed projects by Centria RDI

S.N.	Area of RDI	Ongoing Project	Completed Project
1	Chemistry and Bioeconomy	LECo- Local Energy Communities (Interreg NPA) EVAKOT (Regional Council of Central Ostrobothnia) ECOLABNET (Interreg Baltic Sea Region)	BBI - Bothnia Business Innovation (Regional Council of Ostrobothnia) FATLASE - Fatigue durability of laser clad components (EU's Interreg IV A North program) Arvopilotti (EAFRD, Mainland Finland's Rural Development Program)
2	Production Technology	MITATEN – Tuotantoprosessien vakautus mitaten (Council of Oulu Region) Trinity (H2020, EU) RoboSol- Collaborative Robotic Solutions for development of sustainable micro, SME and large-scale industries (Interreg Nord)	CMT - Nordic business opportunities from coating and additive manufacturing (Interreg Nord) PuuAsTe – Puutuoteteollisuuden asiantuntija- ja testauspalvelujen kehittäminen (Council of Oulu Region) TARGET – Making Regional manufacturing (Interreg NPA)
3	Digitalization	DEMETER - Building an Interoperable, Data-Driven, Innovative and Sustainable European Agri-Food Sector (H2020) 5G-FORCE - 5G Finnish Open Research Collaboration Ecosystem (Business Finland) BILINE – Digital solutions for the security of the industrial area (Regional Council of Central Ostrobothnia)	XNET – Web applications for digitalization (Regional Council of Central Ostrobothnia) 5G Test Network+ (Business Finland) CORE++ Cognitive radio trial environment (TEKES)
4	Entrepreneurship and well-being	Story BOOST- Small business, big story (Leader Aktion Österbotten r.f. and Niilo Helander Säätiö sr.) RoboSote - Centria health lab (Regional Council of Central Ostrobothnia) LYHTY – Preventing short work absence (Centre for Economic Development, Transport and the environment)	Green Care –A model for higher education (Centre for Economic Development, Transport and the environment) App-Sim – Applied simulation pedagogy (Centre for Economic Development, Transportation and the Environment) Finlandia SPOT - (EAFRD, Mainland Finland's Rural Development Program)

3 GLANCE AT LEAN

3.1 History of Lean

Generally, many people still believe that Toyota Production System (TPS) gave birth to the lean management system. In fact, lean is a relative term which is used to define manufacturing process and has been in existence for the past three decades. The first historical example of lean thinking was introduced during the 1450s when the King Henry II from France visited Venetian Arsenal. He also observed that Venetian Arsenal were manufacturing boats using assembly lines to enhance mass production which was much faster than the common practice at that time. (Charron, Harrington, Voehl & Wiggin 2015, 27.)

By the late 1700, Eli Whitney succeeded to improvise metal working technology by introducing a mass production system. This success was regarded as a revolutionary approach in the production process. Later in 1913, Henry Ford added another pillar in the history of manufacturing system by introducing the world's first moving assembly line at his Highland Park Plant where he succeeded to build Model T car on the basis of changeable parts. This innovation accelerated the production of cars emphasizing mass production. Later, his concept for the assembly line became a standard for mass production. (Charron et al. 2015; Womack 2004.)

In 1926, Henry Ford published a book *Today and Tomorrow*. This book contained most of the concepts used in the Lean manufacturing. In fact, this book proved to be a concert base for the development of Toyota Production System. Later in 1950, Toyota refined its principles by adopting the Ford model by giving birth to the Toyota Production System (TPS) which turned to be the milestone approach behind the grand success of Toyota company. Thus, we could say the concept of lean manufacturing was born at Ford and continued to evolve at Toyota. Additionally, in the history of lean manufacturing other two books added remarkable contribution in the development of lean principle during nineties. *The Machine That Changed the World* (1990) by James P. Womack, Daniel Roos, and Daniel T. Jones and *Lean Thinking* (1996) James. P Womack and Daniel T. Jones have distilled lean thinking even further. (Charron et al. 2015; Womack 2004.)

The contributions made by Tziichi Ohno are also remarkable in the development of lean management. Ohno's two concepts, total elimination of non-value-added waste and investing on the people as the

biggest gain are still regarded as the base of Lean management. Additionally, Ohno is still credited for introducing Seven Waste (7Ws), Kanban board for pull production and 5S tools which are still widely used as crucial Lean tools. (Charron et al. 2015, 48-49.)

3.2 What is lean manufacturing?

Lean manufacturing is an approach for controlling and continuously improving the existing process by minimizing waste in order to maximize process flow. It is a systematic approach which emphasizes guiding and educating employees by practicing lean principles and philosophies across an organization. In general, lean management is principles focusing on the deduction of waste, inventory and customer response time. (Charron et al. 2015, 1-3.)

In the early days of lean journey, lean was confined only within the development of the manufacturing company. The entire goal of lean was to speed up the manufacturing process by eliminating waste (process/steps) but in today's competitive business world, the definition of lean has completely changed. Today, lean is for everyone who wants to have real sustainable results in professional life. (Byrne 2017.)

By this date, lean thinking has been flourishing throughout the world. In fact, it is being adapted and developed as the company culture. Apart from manufacturers, lean tools and principles are used in logistics, distribution, services, retail, health sector, construction sites etc. and many more. Furthermore, lean conscience and methods are deep rooted among service managers and leaders. Those organizations who have adopted lean could improve continuously by valuing customer according to their demand. Today, lean is reformed and being adapted as Lean Six Sigma by many organizations. (Charron et al. 2015; Morgan & Jones 2012.)

3.3 Why Lean manufacturing?

According to Frank Voehl, lean without management is a pipe dream, and management without lean is bad dream (Charron et al. 2015, 1). This means lean without management is impossible to carry out and management without lean is similar to a nightmare. Thus, lean and management can also be considered as two sides of the same coin which should go hand in hand. (Taghizadegan 2006.)

The entire goal of every organization is to improve its bottom-line and this can only be achieved by valuing the customer i.e. by obtaining customer satisfaction. Until and unless our customers are satisfied then there is no point of increasing production of goods and services. The core idea of lean is to mitigate delays, errors and waste from a production process in order to balance speed, efficiency and acceleration. Additionally, it also emphasizes the continuous improvement of process according to the need and demand of the customer. (Charron et al. 2015.)

There are various advantages of adopting the lean manufacturing system. For instance, it helps to identify and eliminate all non-value-added steps that slows down a process. Thus, employees can focus on the activities which can bring value to the process. It contributes to increasing the efficiency and speed of the process which will also increase productivity by maintaining balance between employee and process. It helps to maintain customer satisfaction meeting customer expectation. Thus, lean will assist in delivering value to the customer. Similarly, one of the major advantages of lean is the reduction of manpower. This will aid to reduce the lead time of the process. It also helps the project to be done under the deadline and possibly under the assumed budget by establishing a pull system. Last but not least, it also assists in reducing operating cost by increasing profitability continuously which is also explained below figure 3. (Majewski 2017; Taghizadegan 2006.)

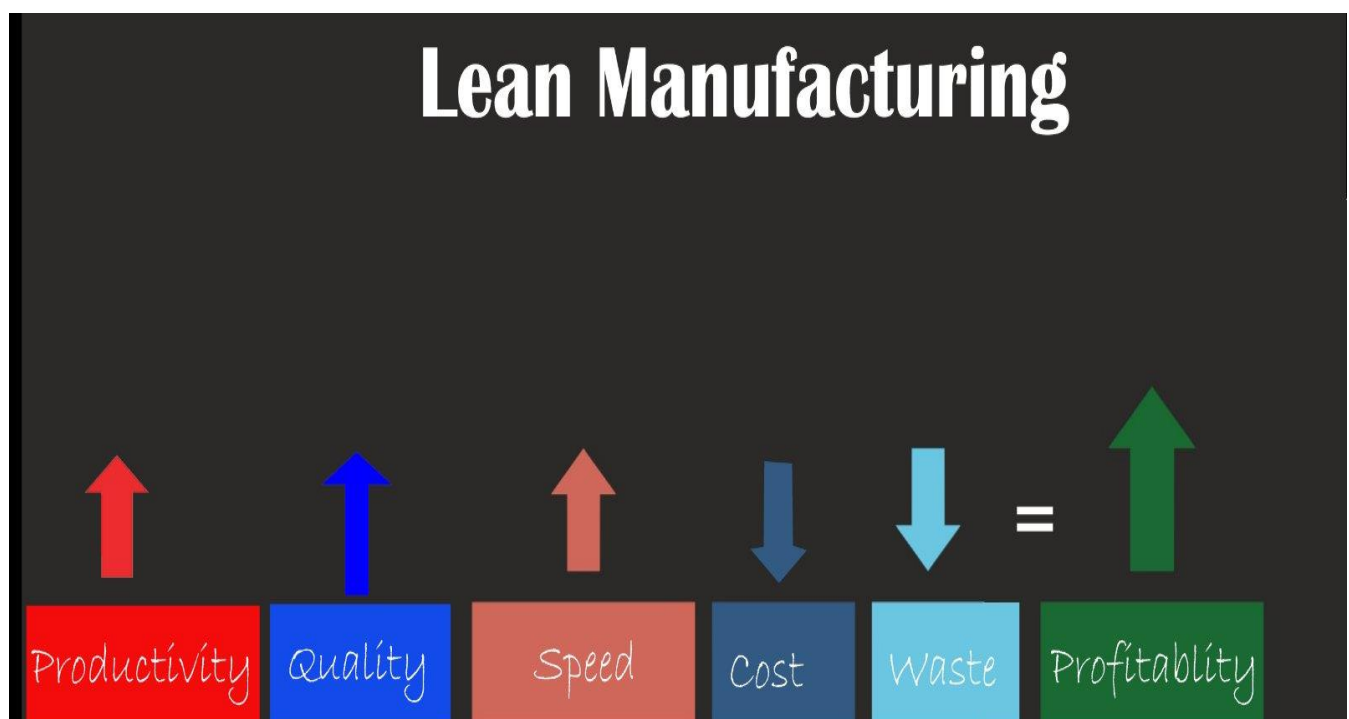


FIGURE 3. Lean Manufacturing (adapted from web-cab)

4 LEAN PRINCIPLES

For the first time in the history, five principles of lean manufacturing were described by Womack, Jones & Roos in their book, 'The Machine That Changed the World' and these are widely accepted and followed till the date. Today, the five lean principles provide a base for creating an efficient and effective organization culture. These principles enable to identify inefficiencies in the process which allows manufacturer to deliver better value to the end-customer. Lean principles emphasize in creating customer focus working environment by addressing the needs of customers by deploying continuous improvement culture. To sum up, these five lean principles in figure 4 shape the future of an organization by making the process competitive, reducing operational cost, increasing profitability and building a good reputation of the organization in the market. (Morgan & Jones 2012; Byrne 2017.)

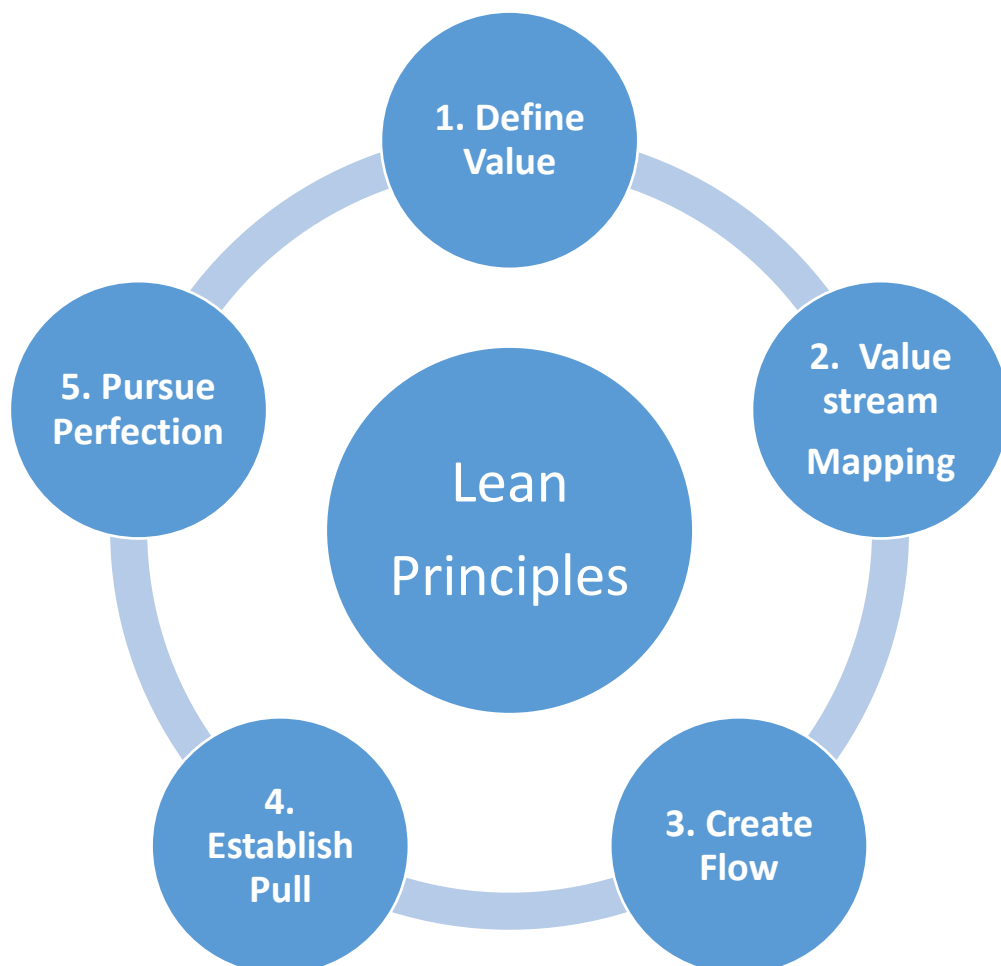


FIGURE 4. Five principles of Lean (adapted from Do)

4.1 Defining Value

Value is regarded as the first and foremost principle of lean management which is one of the triggered aspects of lean thinking. Before understanding how to value our customer it is also very crucial to understand what value is. In general, value is the amount of money which is paid by the customer in order to enjoy any goods and services. Additionally, there are also intangible values which add values to the product or services. In some cases, a customer might have a dilemma, they might not know what they really want or might not be able to articulate their actual needs. So, it is the prime duty of a producers to value their customer. They can carry out several techniques such as surveys, polls, interviews on different demographic basis and analyse them to find out what they really want, why they want, what is fault in the current product, how can we improve, and what price they can afford. In this way customer can be valued. (Do 2017.)

4.2 Value Stream Mapping (VSM)

Recognizing the customer's value could be a baseline to identify all those factors which are crucial to contribute these values. It can also be referred to re-engineering because it helps to identify and eliminate both necessary and unnecessary non-value-added waste and steps from a process. By removing and deducting the unwanted process or steps will make ease to meet customer requirements. To sum up, VSM can be defined as a visual tool to identify all the phases of the operating process in a manufacturing plant with cost effective results. (Crawford 2016.)

4.3 Create Flow

The core idea of VSM is to identify and eliminate waste to ensure that the upcoming steps will flow continuously without any interruptions. If the value stream stops moving forward at any phase, it is impossible to avoid waste in the product. For this reason, the steps during value creation should be carried out in tight sequences. Thus, product or services will flow smoothly towards the end-customer without any hinderance. (Do 2017.)

4.4 Establish Pull

According to Do, inventory is regarded as one of the biggest challenges for a continual production process. That is why stock is considered as the biggest waste in any production line. To overcome this challenge, a pull-based system is introduced to emphasize Just in Time (JIT) production. The primary goal of a pull-based system is to limit unnecessary inventory and work in progress (WIP) items which will help to minimize unnecessary stock deducting higher production costs. To sum up, the pull system ensures to produce and deliver the right materials at the right time in the accurate quantity with minimal inventory. (Do 2017.)

4.5 Pursue Perfection:

After identifying values, creating VSM, creating flow and adopting pull system there comes the last principle of lean management as a part of organizational culture i.e. continuous improvement. This last step is very crucial because it helps to cope with dynamic needs of a customer. The company should be customer oriented. Manufacturer should be clear that their business is running because of the customer. So, they should try their best to add new flavor in order to sustain in this competitive business market. (Do 2017.)

5 FOURTEEN LEAN TOOLS

5.1 Value stream mapping (VSM)

VSM is an effective tool of lean which helps to see the physical flow of a process visually and guide to create values for our customer. VSM is composed of a diagram which shows how information flows and is processed to manage, control or influence the physical flow of the material. The key process steps of VSM are depicted with the help of data related to flow, quality, lead time and capability related to takt. This helps to identify all the steps of operations in the production process with cost-effective results. This tool enables to plan the future and current state of resources visually by mapping VA and NVA activities. It is regarded as a crucial lean tool to identify and eliminate waste for the continuous flow of any process. (King 2009, 11.)

5.2 Takt time

Takt time is a tool to measure the total customer demand which is expressed in time factor. It is the demand rate of customers for any products. It means how fast the manufacturer need to increase the manufacturing rate in order to meet the customer demand mitigating over production. The word takt is derived from a German word which means rhythm or beat of drum. The core idea is to create a balance between every parts of manufacturing process to meet the rhythm of customer demand. (King 2009, 61.)

5.3 Kaizen

Kaizen is a small incremental change which is made continuously to improve productivity and minimize waste. It is a Japanese term where; kai means change and zen means for better. Thus, in general Kaizen means changes for a better purpose. (King 2009, 12.) Furthermore, planning and execution of Kaizen emphasize for continuous improvement which will help to analyze the workflow of the process and bring immediate improvement if necessary. So, the main idea is to engage all employees to remove waste for good changes in any process. (Martin 2009, 5.)

5.4 Jidoka

The Jidoka concept was invented by Sakichi Toyoda and later developed and extended by Shigeo Shingo (Dennis 2007, 106). In general, it is automation with a human touch which emphasizes equipment with artificial intelligence to stop automatically when it senses off-quality products are produced. The core idea of Jidoka is that everything must be stopped at the first sign of a quality problem so the problem can be corrected instead of resuming later from beginning. This helps to cut waste which are produced during production phase. (King 2009, 12.)

5.5 Five S (5S)

5S is the name given to a five-step process to organize and standardize our workplace. The core idea of 5S table 2 is to boost these factors: the quality, cost, delivery period, safety and mobilization of a process.

TABLE 2. Five S (5S)

S.N.	Japanese Term	English Meaning	Detailed tasks to do
1	Seire	Sorting	Carry out detailed study, identify, select and eliminate all unwanted waste (items and steps).
2	Seiton	Systematize (Set in order)	Set all items in systematic order under our comfort zone.
3	Seiso	Shine	Keep your workplace tidy.
4	Seiketsu	Standardize	A high-level standard is set after implementing 3S: sort, systematize, and shine thoroughly.
5	Shitsuke	Sustain	Establish a system where everyone follows these standardized steps as a part of organizational culture.

5.6 Single Minute Exchange of Dies (SMED)

SMED is a systematic analysis of all the tasks to be performed in a product changeover. The main idea behind this is to simplify the changeover and perform tasks in less time. This process was developed by Shigeo Shingo, who was an industrial engineer consultant in Toyota during the developing phase of

TPS. Additionally, SMED has been very successful in the process industries for the annual shutdown and overhauls of some process. (King 2009, 13.)

5.7 Poka-Yoka

Poka-Yoga is one of lean tool where poka means an inadvertent error and yoke means prevention (Dennis 2007, 98). Thus, it is a set of techniques which can be used for proofing a mistake. It helps to prevent production of defective products and mitigates problems caused by the improper positioning of production equipment. In the beginning it was popular as baka-yaka which means fool proofing and later it has been changed to poka-yoka which means mistake proofing. (King 2009, 13.)

5.8 Five whys (5W)

5W is another lean technique developed by Toyota to find the root cause of any problem along with its solution by asking why five times. Sometimes it might take more than five times to get into the root problem and sometime even less than five. To sum up, the main idea is to ask why continuously until we get into the real problem of the process. (King 2009, 13.)

5.9 Standard work

Standard work means optimizing specific tasks to be performed by an operator, including the sequence of operations and timing. The core idea of this tool is to perform each job in an optimum way to optimize the process by deducting variability from the entire process. (King 2009, 13-14.)

5.10 Total Productive Maintenances (TPM)

Basically, TPM is a set of practices which is aimed at improving the performance of a manufacturing process by improving the way that equipment is operated and maintained. The prime goal of TPS is to develop robust, stable value streams by maximizing the overall equipment effectiveness (OEE). (King 2009, 14.)

5.11 Cellular Manufacturing

Cellular manufacturing is one of the lean tools which emphasizes dividing the full product line up into families of products requiring similar processing steps and conditions. The main idea behind this is to dedicate specific pieces of equipment to each family resulting in a shorter changeover, reduction of variability, increased throughput, higher quality and a better flow without any interruption. (King 2009, 14.)

5.12 Heijunka

Heijunka is the process of levelling the volume of material being produced over a time. The main idea of this is to make the production process to a level takt. Heijunka increases operational stability and deducts variability in resource utilization and raw material requirement. Thus, it is also known as a technique of levelling production or smoothing production. (King 2009, 14.)

5.13 Just-In-Time (JIT)

JIT means producing the right amount in the right quantity at the appropriate time (Dennis 2007, 91). It emphasizes manufacturing the product only after receiving an actual order from the customer rather than producing based on a forecast. It helps to cut-off waste, excessive inventory, unproductive waiting, motion and logistics. JIT is regarded as one of two pillars of Ohno which enables a company to manufacture what is needed and in the exact quantity. The core idea of JIT is not to produce more nor producing before it is needed.

5.14 Kanban

Kanban is one of the vital lean tools which is widely being used for visually signaling steps of any process. Originally, the word Kanban comes from a Japanese term which means visible sign. In the early days, it was implemented with cards system, bins, or totes marked with the quantity to be produced. They were used to use to represent the lot size, specific product or material type. (King 2009, 15.) To sum up, Kanban is an effective lean tool to regulate the flow of information and materials between employees by connecting sequential VA process steps (Charron et al. 2015, 267).

6 TYPES OF WASTES

In general, waste is anything that does not add value. So, in order to identify waste, we must identify value first. According to lean principle, value is defined by our customer. So, it is very important to identify what the customer wants from the process or value stream. This will help to identify and eliminate waste from the process. (King 2009, 37; Skhmot 2017.)

If we look back in the history of waste, the seven waste was introduced in Japan where it was known as muda. Later, Taiichi Ohno introduced eighth waste and further created the category of the muda. Following his idea Toyota Production System make boom in the history of lean manufacturing process. The ninth waste is behavior waste. It is regarded as the root cause of all the eight wastes. Ohno concluded that identifying and eliminating all waste is the key to raise productivity and become competitive. (King 2009, 37-38; Skhmot 2017.)

6.1 Over production

Generally, overproduction means producing more than required. It occurs each time when we engage more and more resources than required to deliver our end customer. Overproduction can be marked as the worst waste which is the source of many others waste. For instance, overproduction requires excess inventory, which in return results to the waste of motion and transportation. Additionally, it also requires more employees, equipment, and facility space, which will have an adverse effect on the productivity and profitability of the company. (Charron et al. 2015, 165.)

6.2 Defects

In general, a defect means something which is not expected by the customer in any products or services. Most of the defects are incurred during assembly process. It also includes a product or service that needs manual inspection and repair or rework. Simply, a customer did not want to pay for a defective product. Thus, the manufacturer must cover all expenses incurred during the reworking, rescheduling and maintenance of the product and service. (Charron et al. 2015, 172.)

6.3 Over-processing

Over-processing is extra processing which does not add value to the product or service from the customer's perspective. During the production process, there might be some steps demanding extra and unnecessary effort. Additionally, there might be repeated steps due to non-standard processing which consumes precious time of employees in vain which could be used for other productive work. (Charron et al. 2015, 175.)

6.4 Skills

Waste due to skills often occurs when we are unable to identify and harness people's mental, creative, innovative and physical skills or abilities of our employee. In the case of those companies or organizations which have been practicing lean culture this waste exists to some extent. (Charron et al. 2015, 189.)

6.5 Waiting

In simple, waiting means the waste of time in hand. This waiting time could be human waiting time, machine waiting, or materials waiting to be processed. There are various reasons for waiting and some of them are: delays due to material conveyance, breakdown of machinery or equipment, working speed of operators (too fast or too slow) and an excessive or insufficient number of employees. (Charron et al. 2015, 180.)

6.6 Transportation

Waste due to transportation is caused due to any activity that requires transportation of parts and goods around the facilities. Generally, transportation waste deals with the actions related to the movement of the parts or goods which might come in many forms such as carts, forklift, wheelbarrow, golf carts, rolling racks etc. (Charron et al. 2015, 186.)

6.7 Motion

The waste of motion occurs during the movement of people or information that does not add value to the product or service. For the continuous flow of any process there should be a proper connection of materials, machines, human power, and methods. This helps to achieve the highest levels of quality, productivity, and profitability of the organization. (Charron et al. 2015, 183.)

6.8 Excess inventory

In any supply chain where the excess of goods retains for any length of time, inside or outside the factory which raise inventory cost is called Excess inventory. Excess inventory includes raw materials, work-in-progress, assembly parts, finished parts, unread email etc. which will not add value to the product or service. Excess inventory will always require more people, more resources, more equipment and more facility space and thus it is termed as waste in the manufacturing process. (Charron et al. 2015, 169.)

6.9 Behavior

Behavior waste is the ninth waste which is the root cause of the other eight common wastes. To be more precise, it is results of human interactions. Everything we do, say and do shape the behavior of all employees and we let them go in the direction of creating value for the customer or waste for the company. Every organization has behavior waste to some extent. Specially for those companies that intended to apply lean effectively and tightly, the identification and elimination of behavior waste is very crucial. (Charron et al. 2015, 191.)

7 INTRODUCING CENTRIA WOOD LABORATORY

Centria wood laboratory is part of Centria RDI which is situated in Joutsentie 11, Ylivieska. One of the key responsibilities of this team is to carry out surface treatment in order to serve wood industries for better processes. Low carbon consumption is taken into account in most of the projects conducted by the team of Centria wood laboratory. On the top of this team there is the RDI manager and under him there is the RDI co-ordinator who is responsible for preparation and implementation of various projects and services. The other members of the team are RDI specialist, Development engineer and RDI developer who has strong understanding of the wood products and industrial processes. Additionally, this team has strong knowledge of lean simulation and office lean, CE marking, finishing technology, quality expertise and low carbon building and construction and process simulation. The following figure 5 will explain about organisational structure of Centria wood laboratory.

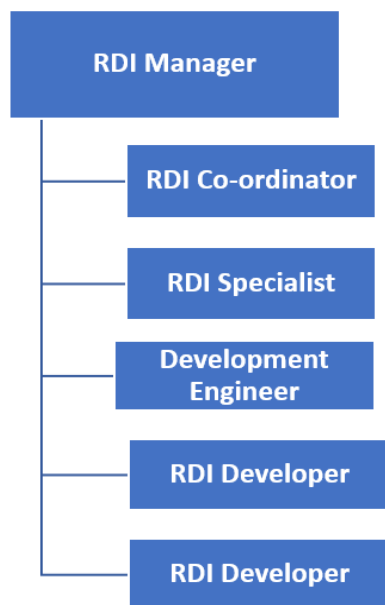


FIGURE 5. Organizational structure of Centria wood laboratory

Centria wood laboratory is a part of the RDI unit of Centria UAS. Since 1997, it has been manufacturing timber products to develop and support timber business operation in the local region. The main respon-

sibility of the wood laboratory is to carry out research and development activities in projects, paid services activities and training related to wood and wood construction product industry. To sum up, Centria wood laboratory contributes in the sustainable development of Ostrobothnia region. (Centria UAS.)

8 BACKGROUND OF THE TASK

Before signing the internship contract, all the tasks and responsibilities to be carried out during internship tenure were briefed in detail. The primary goal of the internship was to develop a real-time visual system in order to visualise and control the RDI tasks in the Centria wood laboratory by using the lean method. In simple, as a part of the internship, the trainee had to create a clear picture which would help to monitor and analyse the status of the ongoing and upcoming projects visually in real-time. The main idea behind this was to contribute to the successful completion of projects without any hinderance.

When the internship period started, the first task was to gather detailed information of the Centria wood laboratory. In the new workplace with an unfamiliar environment it was quite challenging to develop a proper system which would help to visualise and control RDI tasks. Additionally, it was also essential to find better ways to lead and keep track of the RDI tasks in real-time without any obstacles. Due to the fact that no one could introduce Centria wood laboratory better than the its employees, it was crucial to be familiar with the employees of Centria wood laboratory. Thus, another task was to be familiar with the employees and make them comfortable with whom they are going to share their workplace. This was essential because they could only guide towards the proper direction by providing detailed information about the Centria wood laboratory. Building personal and professional relations in real time and in a novel environment was quite a hard task during the starting days but still effort was made to gather detailed information about Centria wood laboratory.

Interviews are one of the powerful tools to investigate issues in an in-depth way which will help to analyze and forecast the current and future situation respectively. As a part of solution, every employee of Centria wood laboratory was interviewed. Altogether 20 questions were prepared and each employee working in the Centria wood laboratory was personally interviewed by booking appointment which could be viewed from appendix 1. The main idea of that interview was to identify the current problems and their solution in managing and leading the RDI tasks in the multi-project environment without any interruption.

In fact, the interviews were remarkable approach for the completion of the research project as they guided towards the root cause of the problem which was prevalent in Centria wood laboratory. Furthermore, the interviews helped to know about the responsibilities of the employees including their professional background. It also provided an idea how challenging projects are being managed and lead. The

interviews helped to know about the progress made by the Centria wood laboratory during the past years. Additionally, the interviews also provided information about the factors which should be considered for the successful completion of the project. Moreover, the interviews also helped to know about the nature, responsibilities, skills, perception, opinions and problems of the individual employee working in Centria wood laboratory. To sum up, the interviews helped to enlarge knowledge regarding the limit, capacity, operational process and overall picture of the situation prevalent in the Centria wood laboratory.

On the basis of the study and the analysis of the Centria wood laboratory, the following picture 2 was used to describe the problems which decreased the speed and quality of the ongoing projects in the Centria wood laboratory.



PICTURE 2. One of the problems of Centria wood-laboratory

For instance, let us consider Centria wood laboratory is a beaker which has limited resources, employees and capabilities. Every year, Centria wood laboratory receives many projects related to external and internal services. The most interesting fact is that it accepts every project offered to it. In general, Centria wood laboratory had to accept every task provided to it. It was also true that they were compelled to do so because there was no accurate assessment tool for the selection of projects systematically. To be more

precise, Centria wood laboratory is conducting too much tasks beyond their actual capacity which will have adverse effect in the deadline and quality of the work.

For a healthy operation of business, saying no will also play a crucial role. Let us imagine a situation that water is continuously being filled into a tank which has a small outlet as compared to its inlet. Therefore, after a certain period of time, water will start to overflow from the tank when it cannot resist water pressure. If the same situation is compared with Centria wood laboratory, the same consequence could be found. Thus, it is very crucial to understand the limit and capability of Centria wood laboratory before accepting tasks offered to them. Moreover, Centria wood laboratory also can set limit of the tasks which can be carried by them.

Additionally, it was also essential to categorise the tasks on the basis of their nature. This will help to increase the visibility of the tasks by decreasing their complexity. It is similar to create folder in the computer according to the nature of the document. Thus, classifying the tasks according to their nature will always be beneficial and fruitful. This will help to save time and make tasks more effective and efficient.

9 DEVELOPMENT PHASES

Based on the study and analysis of the interviews carried among the employees of Centria wood laboratory the following conclusions were made. Every year Centria wood laboratory receives many projects related to the external and internal service. Thus, with the increasing workload, it was crucial to develop a proper visual system in order to control and develop RDI tasks in a multi-project environment. Additionally, Centria wood laboratory should focus on increasing its working capacity without compromising the quality of the work accordingly.

On the basis of research actives, the main difficulty in carrying and monitoring projects in Centria wood laboratory was the lack of proper visualization system which was also considered as the root cause for many obstacles. There is a saying a picture speaks more than a thousand words and thus it was essential to develop a new Kanban board which is one of the effective visual tools. The main motto behind constructing a new Kanban board was to make more convenient to visualize the ongoing projects and tasks in Centria wood laboratory.

The best way to address the problems mentioned earlier was to build a new Kanban board which is also regarded as one of the crucial lean tools among fourteen. It was believed that a new Kanban board would enable leading different tasks and projects in a systematic way. Additionally, this new Kanban board would assist employees to monitor status of different projects and complete them with success without any hinderance. After realizing the desired goals could be achieved by applying lean management, Centria wood laboratory decided to develop and practice lean management as an organizational culture.

Lao Tzu has said that a journey of thousand miles begins with a single step (BBC). Keeping this fact in mind, Centria wood laboratory started to continue its lean journey by practicing 5S tightly. So, the first lean approach was made by marking yellow lines on the floor to place different equipment picture 3. The main reason behind this was to form a habit of putting things in the right place so that everyone could access them easily whenever they are needed. Everyone in the Centria wood laboratory were hopeful that this approach would help to reduce wasting time and prevent accidents in the workspace.



PICTURE 3. Practicing 5S by marking lines on the floor

10 KANBAN BOARD

A Kanban board is a management tool which helps to visualize work for its continuous flow by maximizing its efficiency. It is a signal system flow of goods and process with the help of colorful cards which informs the employees of what to do next and how to commence. Kanban board is one of the significant lean tools which helps to optimize the flow of work with mutual understanding between employees. Generally, colorful cards are used on the white board which help to communicate the status, progress and issues of the ongoing tasks. (Kanbanize 2020.)

Kanban is a Japanese term which means a visual signal. During our work many things are often invisible and intangible. The Kanban board was introduced to visualize work and convey information to everyone working in the same line. It places a high value on the simplicity and visual nature of the project management board to enhance the flow of work and delivery. Kanban helps to communicate with a series of process steps for the continuous flow of work. There is no doubt that Kanban helps to establish collaborative understanding in the organization. So, Kanban is also regarded as a Holy Grail of the Lean principle. The following picture 4 was early Kanban board used by Japanese people. (Charron et al. 2015, 267; Kanbanize 2020.)



PICTURE 4. Early Kanban board used in Toyota (adapted from Toyota)

The Kanban board is a physical representation of the process which depends upon the team members who pull precise task whenever they are needed precisely i.e. JIT (Just in Time) concept. For the first time in history, Kanban was practised by Toyota motors during manufacturing process. Generally, a basic Kanban board has three columns: to do, doing and done picture 5. Team members will move the cards horizontally across the board from the left to the right in order to symbolise the flow of tasks. The different colours of cards are used to signify priority tasks, assignees or any other information relevant to the project.

To sum up, the Kanban board is a highly flexible and effective process to monitor work in progress (WIP) which will help the organization to meet its strategic goals. Furthermore, it also helps to predict possible risks and their solutions which will help to increase the agility of the organization. (Smartsheet.)



PICTURE 5. Basic Kanban concept

11 THE KANBAN PRINCIPLES

Kanban method is a positive operational approach to uplift an evolutionary process which would contribute to bringing revolutionary changes in the organization. Kanban is very simple, visible, accessible and transparent. It helps to increase the visibility of complex tasks and projects by breaking them down into sub-tasks and steps. Furthermore, it also allows one to monitor and analyze work in progress. On the basis of the following Kanban principles it is practiced by implementing pull in order to optimize the flow of the work with the mutual co-operation between employees and the process. (Kuisma 2019.)

11.1 Visualize work

In general, the first and foremost principle of Kanban is to visualize the work. Kanban would never forbid a workflow, rather it emphasizes the documenting steps in a way that can be visualized and understood clearly by everyone. If we are interested in upgrading our process by implementing Kanban, then we should map the current process as it exists. Then only, opportunities for improvement via Kanban become clear. The main reason behind this is that we cannot improve a current process until we are sure what to improve and where to improve. (Roussel 2014.)

11.2 Limit the work in Progress (WIP)

The prime goal of the Kanban board is to move every task efficiently from the beginning to the end mitigating waste. This emphasizes limiting the amount of work which can be completed in the given time frame. To be more precise, Kanban is a tool to implement the pull system. For instance, in supermarket, inventory is pulled from the warehouse to the shelf only when customers demand for the specific product increases. So, the Kanban approach moves tasks from one phase to the next only when it is pulled through by customer demand. So, in order to avoid bottlenecks, work should never be pushed forward. (Roussel 2014.)

11.3 Manage flow of work

When the first two principles of Kanban are implemented, then it will make easier for the continuous flow of the work. After that we should focus on finding possible defaults in the process. This will help for the continuous flow of the work without any hinderance. Additionally, this will assist in the additional visualization and improvement of the process. (Roussel 2014.)

11.4 Make process explicit

The Kanban board will make the process clear. If people know what they are doing now and what to do next, then there will be no confusion. This will help to flow work in the required direction without any interruptions. Every employee can access and understand the Kanban board which will make the process clearer and simpler. (Smartsheet.)

11.5 Continuous improvement

Developing Kanban is an ongoing process which will never be completed rather it will be continuously improvised according to the need and situation of the time. The Kanban performer should monitor and analyse the Kanban process constantly in order to find the best way to improve the current process. In this competitive business market, conditions, resources and customer taste are dynamic so it is crucial to monitor the flow of process and identify for blockers or frictions which can be removed from a production line. (Roussel 2014.)

12 THE KANBAN VALUES

Generally, the Kanban method is composed of nine values where respect is regarded as the foundation on which the other values are built (Meiling 2018). The nine values of Kanban are described below:

12.1 Transparency

The Kanban board is regarded as an open source of information which can be viewed and accessed by everyone in the organization. It contains clear and unambiguous vocabulary, so it is easy to understand. Thus, Kanban helps to create transparency in the working space. (Meiling 2018.)

12.2 Balance

The Kanban board plays a crucial role in balancing WIP. For instance, the successful implementation of Kanban board will be followed by regular checking of the workflow. In case of some obstacles, users can pause the new work and continue to complete the old one. This will give an idea to shorten the cycle time and delivery rate which will decrease work pressure. This will automatically keep the team and clients happy. Additionally, due to better management of what the team is focusing on, the user can make balanced choices with regards to do the actual work and take initiations to improve the process. (Burrows.)

12.3 Customer Focus

Customer focus directly refers to the act of valuing customer. Our goods and services should be customer oriented. If products or services do not deliver value to the customer then all of our time, effort and resources are wasted in vain. We should never forget that customers are the key to our business. (Burrows.)

12.4 Workflow

Generally, workflow means the ongoing process continuously, without any interruptions. It is an effort to get positive results in a specific way. Kanban enables to recognize and maintain the continuous flow of work without any interruption. (Meiling 2018.)

12.5 Leadership

Leadership is vital at all levels in order to generate value and achieve desired organizational goal (Meiling, 2018). Leadership is aligned with Kanban to encourage and support leadership and initiative at all levels of an organization. A good leadership will facilitate self-organization and individual ability to change for the common good of all team members. (Burrows.)

12.6 Understanding

In general, understanding means self-awareness. It is the state of being ready to move forward both from the perspective of individual employee as well as from the entire organization without any dilemma. We should know, what we are doing and why we are doing. Understanding helps to see and analyze how the process was working before and what were bottlenecks in it. This understanding will help to impose Kanban effectively in the current process. There is a saying: a little knowledge is dangerous. Thus, Kanban users should have clear understanding of the problem what they are going to change which will guide them towards the positive direction. (Burrows.)

12.7 Agreement

Basically, agreement is a state where all parties have agreed to pursue goals together with mutual cooperation. While working in a team, various opinions and approaches of colleagues should be respected by everyone. The common goal will be to converge different views and ideas with mutual understanding. When the final verdict will be passed from the joint commitment of the team members, then the team will start to work out for the implementation of the necessary improvement for the joint achievement of the objectives. (Meiling 2018.)

12.8 Respect

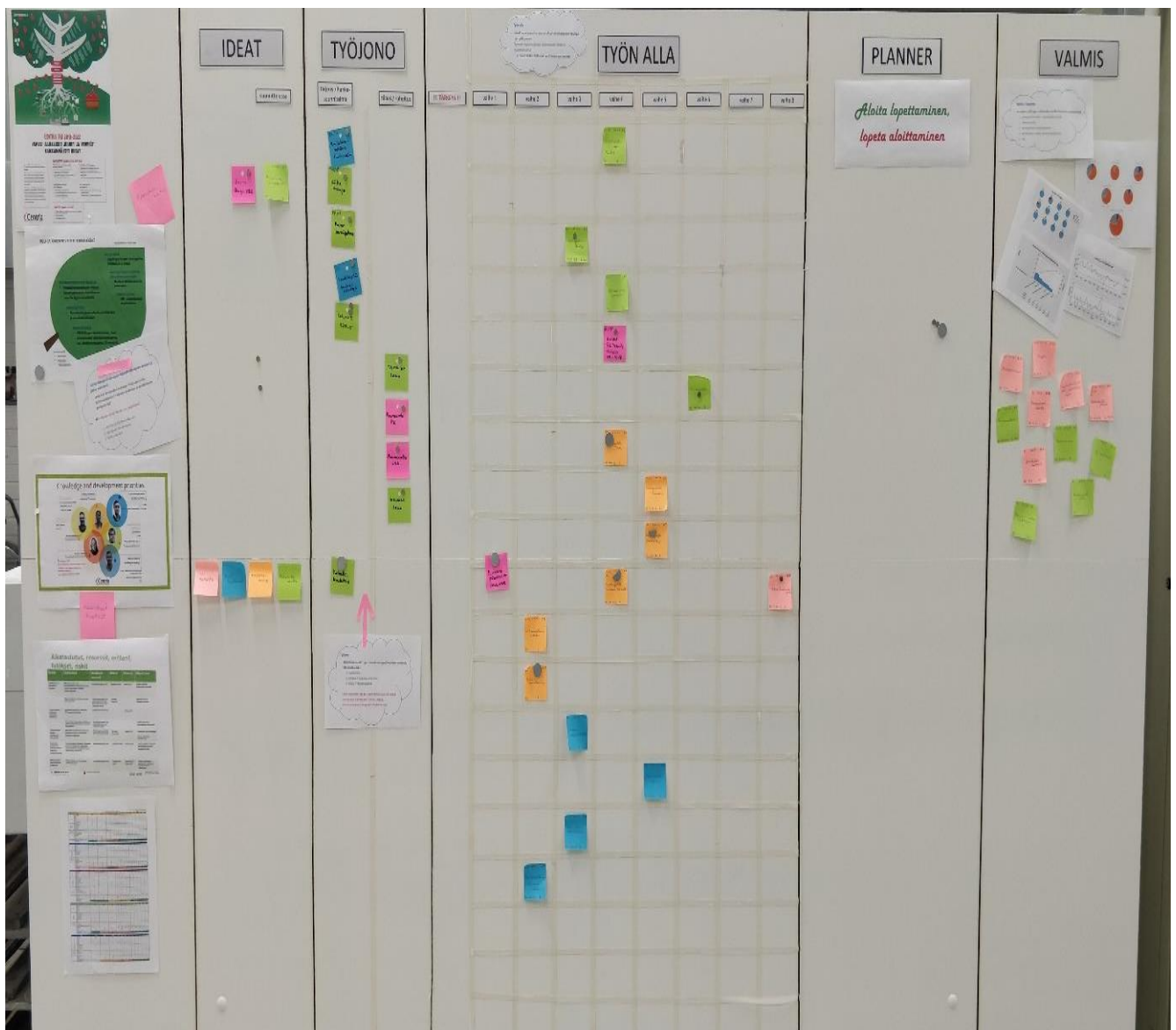
Respect is regarded as one of the pillars of lean. It suggests adopting the current roles and responsibilities within the change undergoing in any organization. There is a saying: respect to be respected. So, showing respect to a team and their work will create better chances of gaining their willingness to apply the new approach in the organization. (Burrows.)

12.9 Collaboration

If we look at the previous values such as: agreement, respect and customer focus, we are expected to co-operate together and work beyond our inner team to find solutions and make plans for organizational and process improvements collaboratively. Kanban encourages to put efforts on continuous improvement which will support the growth of the process beyond its comfort zone. (Burrows.)

13 BUILDING A NEW KANBAN BOARD

Before September 2019, the following Kanban board picture 6 was used in Centria wood laboratory. Before that the employees of Centria wood laboratory faced difficulty in visualizing and tracking the ongoing projects and tasks in real time. This caused difficulty in tracking the progress of work. People were often confused of what to do next after completing one task or after facing a problem in any ongoing task. In some cases, situations used to turn more stressful and problematic when they had to choose tasks from a bunch of projects.



PICTURE 6. The Old Kanban board

In the old Kanban board, all projects related to internal and external services were kept in the same place which made tasks more complex and it was difficult to understand the development process. In some cases, it resulted in a communication error due to the poor flow of the information. Thus, it was crucial to develop a new Kanban board which would provide quick and precise information in real time. This would also make the communication process more effective and efficient. The old Kanban board did not contain any specific tool to prioritize projects. In Centria wood laboratory, it was a challenging task to select a project with high priority and determine which tasks should be commenced first. Additionally, it was also difficult to track and monitor the situation of the ongoing and upcoming projects. There should be some tool which would provide information about the situation of the project on the basis of which the project leader can forecast possible difficulties in future. Moreover, the implementation of the new Kanban board was essential to generate a quick response to the unexpected changes and difficulties in the middle of the project.

In order to solve the problems of the old Kanban board the employees of Centria wood laboratory had agreed to replace it with the new Kanban board. Following the general Kanban concept i.e. do, doing and done the new Kanban board picture 7 was designed by adding some more features. The main idea of the new Kanban board was to visualize and monitor on the going tasks in an efficient way.

+

+

Prioritised Project	Steps										Problems	Completed Projects
	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%		

THE NEW KANBAN BOARD

Priority Calculator						Agreed Project	Should we do?	Our Ideas
Project	length	nature	no. of worker	costs	total			

☐

PICTURE 7. Proposed ideas of the new Kanban board

The new Kanban board contained different sections which were used for different purpose. The main idea behind this was to make the Kanban board more informative, transparent and easy to understand.

- **Our Ideas:** This section was designed to place new and innovative ideas which could alter the business structure of the client organizations. Generally, those ideas could be suggested by Centria wood laboratory in order to develop the production process of their clients.
- **Should we do:** This section was created for those tasks which customer or clients wanted to be done by Centria wood laboratory.
- **Agreed Project:** This section was designed to put those projects which were agreed to be commenced. Generally, financed projects are placed under this heading.
- **Priority Calculator:** Centria wood laboratory carries out many tasks and projects at the same time. Project selection from a bunch of projects had been challenging tasks in Centria wood laboratory because every project seemed to equally important. To solve this problem, a new technique was introduced to prioritize project on the basis of four different factors i.e. length, the nature of the task, the number of workers and costs. All the factors of the projects were graded as 1, 3 and 5 according to the nature of the projects. The projects with a higher priority number would get higher priority to be commenced and others will be followed according to the priority number.
- **Prioritized Project:** After calculating the priority number, the higher prioritized projects were shifted to this section and people started to work on it.
- **Steps:** When the project started to move forward, its current situation can be monitored from this section. This section was divided into 10 different parts (each was calculated as 10 %). This will help to give on information on how big a percentage of the task has been completed.
- **Problem:** If any problem occurred in the ongoing project the ongoing task has to be stopped. Then the spot was marked with a red mark in the step section at which point the project was stopped. Furthermore, the reason of the problem was also written which will make the problem clearer. After this, the user can pick other tasks with a higher priority. This will also help to notify why the project was stopped and find a solution for it.
- **Done:** This section was created to place those projects or tasks which were completed successfully.

When the plan of the new Kanban board was presented, everybody in Centria wood laboratory showed their interest in it. Finally, with the common agreement of everyone it was decided to practice the new

Kanban board from week 50, 2019 as Version 1. Since lean means continuous improvement, it was also decided to improve the Kanban board accordingly.

13.1 Kanban board Version 1

On 5th of December 2019, after having a meeting with the staff members of Centria wood laboratory necessary steps for the development of Version 1. Picture 8 of the new Kanban board were taken into practice. Additionally, a separate row was added to remind the employees about the upcoming meetings in the Centria wood laboratory.

+

Prioritised Project	Steps										Problems	Completed Projects
	10%	20%	30%	40%	50 %	60%	70%	80%	90 %	100%		

+

Meetings						Agreed Project	Should we do?	Our Ideas
Priority Calculator								
Project	length	nature	no. of worker	costs	total			

PICTURE 8. Version 1 of the new Kanban board

13.2 Drawback of Kanban board Version 1

In the section of priority calculator, some difficulties were noticed while prioritizing the tasks. For instance, if we look at the following table 3, project B, C and E have an equal priority number. So, it was very difficult to select a task among three with the same priority number.

TABLE 3. Example of priority calculator

Project	Length	Complexity	No. of workers	Cost	Total priority number
A	1	3	3	1	8
B	1	5	3	1	10
C	3	3	1	3	10
D	3	5	1	3	12
E	3	3	1	3	10

13.3 Kanban board Version 2

On 13th of December 2019, there was another meeting where different issues regarding drawbacks of Version 1 were discussed. That meeting concluded to make the following changes and introduce the new Kanban board Version 2 which can be viewed from picture 9.

- To address the problem of Version 1 one more category in the priority calculator i.e. Urgency was added. The main idea behind this was to solve the problem which was discussed earlier regarding projects with the same priority number. Since all the projects are not equally urgent so this approach will be helpful in ranking the project.
- This might happen rarely but in the case of the project with the same priority number, the priority of the project could be selected with the higher number followed by urgency, length, complexity, the number of workers, cost respectively.
- It was also decided to calculate the percentage of completed task in the previous week. The main idea behind this was to monitor the progress rate of the project. A higher percentage will indicate better results. So, this will help to motivate everyone for better performance and plan tasks according to the capabilities of the available resources.

- Different colors of Kanban cards made tasks more confusing, so it was decided to design new cards with detailed information. The main purpose of designing this card was to make tasks more transparent. This will also help to track week number, leader, deadline, resource, goal and priority number of the task. An example of our Kanban card can be viewed in appendix 3.

Prioritised Project	Steps										Problems	Completed Projects
	10%	20%	30%	40%	50 %	60%	70%	80%	90 %	100%		
Meetings												
Priority Calculator						Agreed Project	Should we do?	Our Ideas				
Project	Urge ncy	length	nature	no. of worker	costs							

PICTURE 9. Version 2 of the new Kanban board

13.4 Kanban board Version 3

At the beginning of the new year 2020, we came up with new idea. It was decided to add one more feature in the new Kanban board which was termed as Töiden Jakautuminen which means division of the work on the basis of its nature picture 10. The core idea behind this division was to complete at least 30 % of tasks related to external services. Furthermore, this also contributed to tracking how much time was spent on tasks with different nature and also assisted in keeping the balance between different types of work.

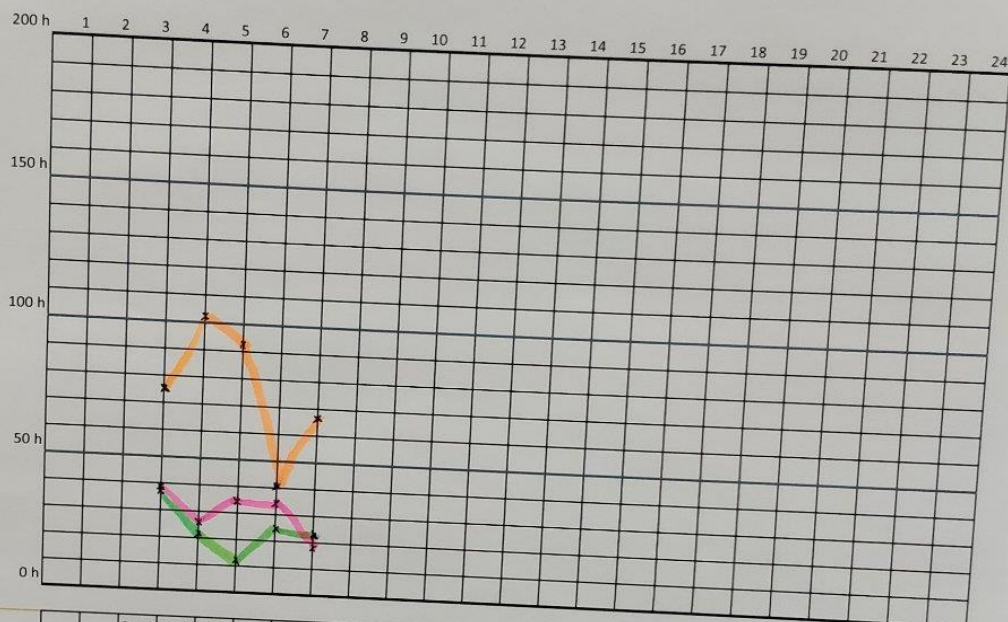
In order to implement this new idea, one big table was designed where week numbers and the number of working hours were denoted by rows and columns respectively. To plot the desired information on

the table, three separate sub-tables were designed in such way that they will have a common week number with the big table. Basically, these three sub-tables were designed to track how many hours are spent by each employee in different types of work. Each column in the table was used to indicate the week number and each row indicated how many hours were allocated for a particular task by a particular employee in the respective week.

Different colours were used to identify tasks with different nature. Hankkeet (projects) was denoted by yellow colour. It was used to track all the projects and research work financed by EU and regional council. Similarly, Palvelutoiminta (services) was denoted by green colour. It was used to track all those external services which were carried to provide services on the requests of the companies and the all the expenses incurred during the services are fully financed by the clients. Pink colour was used to denote Muut (other tasks). It helped to track time which was consumed during maintenance, UAS education and holidays.

At the end, the sum of total hours spent by each employee in a week was used to calculate how big a percentage of task was completed in the respective week. On the basis of the result calculated from those three sub-tables, the main table was filled with different colours indicating how many hours were spent on the respective task in the given week.

Töiden jakautuminen

[illegible][illegible][illegible][illegible]

Hankaralm 7 muut

PICTURE 10. Division of works

Last but not least, one more feature was added to the new Kanban board to evaluate and analyze the results of completed project picture 11. Originally, this evaluation action was developed and used by Robert Waterman in his book, 'What American Does Right' (Waterman 1994, 256-262). He had prepared a list of several questions such as What went well? What was poor? What was effective? Who did it? How it works? What do we put into practice? What do we learn? What we will do better next time? This question set is also known as the Motorola model which was used for Motorola's internal development. There is a saying that one learns from mistakes, so this action evaluating tool helped to analyze the earlier project and guided how to work in the upcoming project.

Tehtyjen toimenpiteiden arviointi
(Motorola-kysymykset)

Mikä meni hyvin? Mitkä tekivät tähän vaikuttivat?	Mikä meni huonosti? Miksi? Miten kehitetään?
Mitä opimme?	Mitä viemme käytäntöön? Mitä teemme ensi kerralla paremmin?

PICTURE 11. Evaluations of actions (adapted from Waterman)

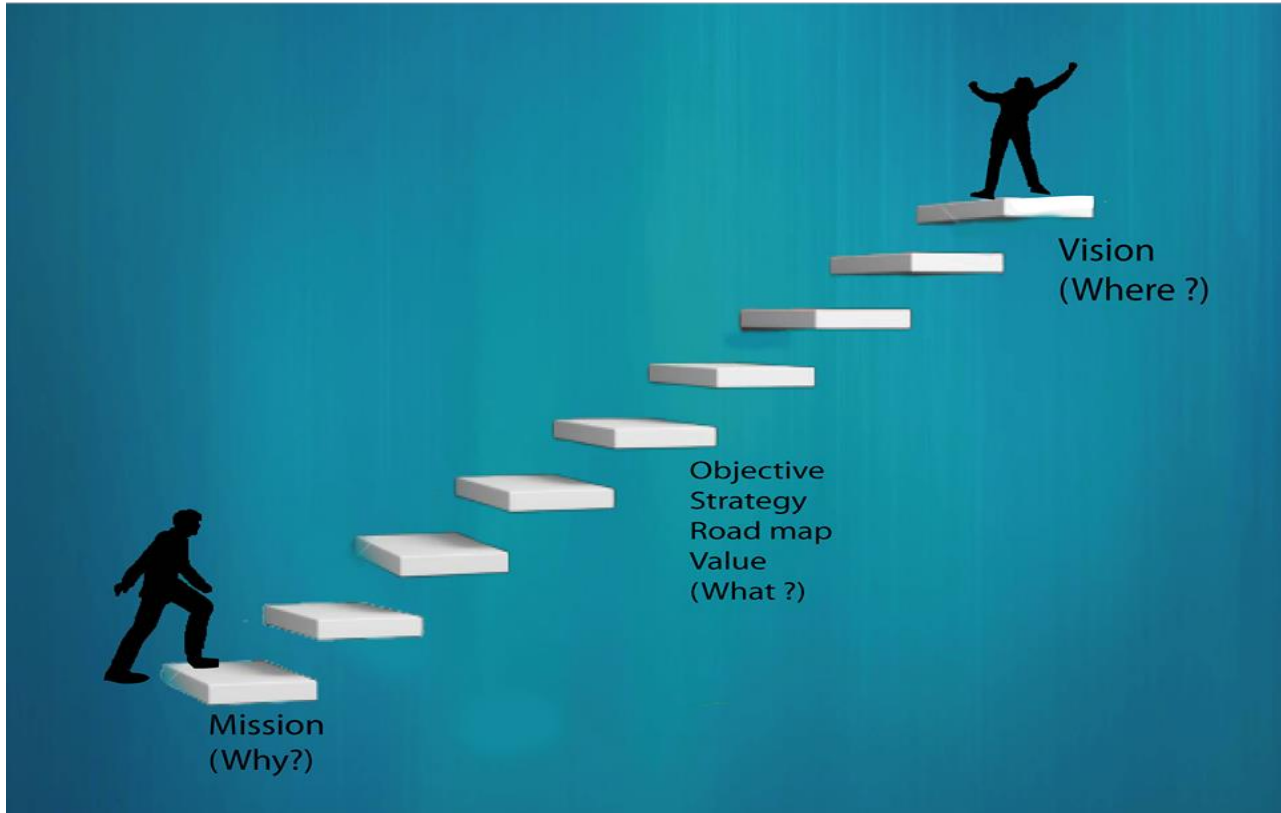
The following picture 12 was the third version of the new Kanban board which has been continuously improved according to the situations.



PICTURE 12. Kanban board Version 3

14 RECOMMENDATIONS

Based on my research, some suggestions have been presented which might take the RDI tasks of Centria to the next level. One of the major tasks during thesis process was developing an effective process to make the visualisation of RDI tasks easier in Centria wood laboratory. Thus, the team of Centria wood laboratory is suggested to create a clear picture of the mission, vision, objectives and values of the project which is being commenced. For instance, employees should have a clear idea where they want to take their company in the future. To be more precise, the vision which is also known as the long-run objectives of a project for a particular time frame should be crystal clear. The people who are carrying out any project should know precisely their mission of the project and why they want to achieve their goals which are set based on their vision. Everyone in the team should have clear objectives i.e. precise targets that are necessary to be expected or desired outcome i.e. goals before planning any project. Furthermore, they should be clear about the strategy and action plan which they are going to apply in order to accomplish their project. It is always wise to have clear picture of the task beforehand. The following picture 13 will depict more about it. (Bindra 2017.)



PICTURE 13. What is mission and vision?

I would also like to focus on one of the common mistakes which might have been a normal practice in our personal and professional life. Basically, we plan much but implement very little. For instance, when we were planning tasks for the Kanban board version 1, we had similar mistake with planning tasks. We had completed only 50% of the planned tasks. This means that a half of the planned tasks were uncompleted. This is one of the main reasons why tasks are not effective. In addition, setting an unrealistic deadline will increase stress and decrease the quality of work. Additionally, setting proper communication between resources and clients will be considered as a positive factor to push the project in the positive direction. So, it will be more sensible to analyse capabilities, resources and set realistic deadlines. Furthermore, Centria wood laboratory can also use project management software such as Gantt chart, Jira, LetsBuild and Monday.com etc. which would help to make projects simple with the help of their smart planning features. (Pinto 2010.)

Based on my studies in Centria wood laboratory, I would like to suggest the RDI team of Centria wood laboratory to apply the SWOT analysis tool before commencing any project. SWOT analysis will make it possible to visualise a clear and bigger picture of our strengths, weaknesses, threats and opportunities during the project. SWOT analysis is an effective tool which will provide a solid backbone to the project plan which will help to mitigate possible risks and optimise the whole process. The project manager could analyse their weaknesses and threats and initiate some new ideas in the areas of improvement in order to overcome them. This will also enable the project leader to plan the next approach if unexpected difficulties occur in the middle of the projects. It will be always wise to have another plan ready to overcome stress and panic situations during the project. So, applying this tool will be very beneficial for the continuous flow of the project without any hinderance. Additionally, this practise will also contribute to completing the project under budget. A sample SWOT analysis for Centria wood laboratory can be found in appendix 2.

I would also like to focus another point which could be applicable to everyone who put their efforts on innovation. In the present era, the key formula to bring revolution in this business market is to address the actual needs of a customer. Dynamic needs of our customer give birth to many innovations. Thus, innovation should be need driven by valuing the actual needs of the customer. Those companies who want to establish themselves in this competitive business market should welcome innovative ideas. For instance, it can also come from their employees. They can conduct a meeting at regular intervals of time involving all employees and ask them to come up innovative ideas. We should motivate them to bring game changing ideas which could alter the structure of the business. Furthermore, we should also reward

promising ideas of employees. This will motivate employees to present revolutionary ideas in the days to come.

I would like to suggest the RDI team of Centria wood laboratory to practice the new Kanban board as a part of organizational culture. This would help to solve most of the problem prevalent in the Centria wood laboratory. The new Kanban board would encourage to follow the culture of prioritizing tasks on the basis of their nature which would suggest users to commence tasks on the basis of high priority. This would also help to avoid starting of multiple tasks and projects at the same time. Additionally, this would suggest breaking projects into tasks and sub-tasks which would help to deduct the complexity of the projects. This would also help to visualize and analyze the flow of the process. For instance, let us take an example of organizational structure of any company. The decentralization of the power and responsibilities among different bodies would makes the operational process more transparent making the execution process of the organization more effective and efficient.

At the end, I would also like to propose the employees of Centria wood laboratory to form habit of visiting the new Kanban board at least once a day and upgrade the progress of tasks and project. This will help to be focused and motivated towards work. Moreover, it also helps to forecast possible barriers and plan possible remedies for the continuous flow of the projects. Last but not least, it is very crucial to practice the culture of continuous improvement in order to achieve sustainable goals for the versatile development of the company.

14 CONCLUSION

It is said that a picture speaks more than a thousand words. Every organization needs to establish a visual control system in order to summarize the current and future state of any project. A visual control system helps to connect different processes and carry them out effectively and efficiently. It also guides employees by suggesting what to do next and how to commence. Thus, a Kanban board was evolved to depict a coherent picture of the process which will facilitate the continuous flow of the process without any hinderance.

The main problem in Centria wood laboratory was the difficulty in visualization which was also the root cause for many obstacles. The best way to address this problem via lean was to build a new Kanban board which is also regarded as one of the crucial lean tools among fourteen. The main motto behind constructing the new Kanban board was to make it convenient to visualize ongoing projects and tasks in Centria wood laboratory. We were hopeful that the new Kanban board will enable leading different tasks and projects in a systematic way. Additionally, this new Kanban board will assist employees to monitor the status of different projects and complete them with success without any hinderance.

The Kanban board operates on the basis of the pull technique which will govern for the continuous flow of work. This will help to draw a coherent picture of the current and future state of the work. We cannot bring changes until and unless we do not know what to change or where to change. The Kanban board will make all these things possible when we start to use it effectively. Once Kanban is implemented then for sure we will start to visualize beyond our imagination.

The RDI coordinator of Centria wood laboratory has concluded that every Friday they have to reserve about one and a half hour just for planning this new Kanban board for the next week. She has also added that it is still worthy because they do not have to worry after planning once. Another RDI specialist has commented that she does not have to worry any more if one of the projects stopped in the middle of it because there is a priority calculator which will suggest which task to pick next. To sum up, everyone in the Centria wood laboratory have welcomed the new Kanban board with a slogan of aloita lopetta-minen, lopeta aloittaminen which means start stopping, stop starting.

At the end, I am hopeful Centria wood laboratory will continue practicing its lean journey in the future as a part of its organizational culture. There is no doubt that by following the path of continuous improvement, we could lead the RDI tasks of Centria UAS towards success. Last but not least, I hope this will not be the end for the evolution of the new Kanban board. I am eager to see the digital version of this new Kanban board in the days to come by following the principle of lean management i.e. continuous improvement.

REFERENCES

- BBC. Learning English. Available: <http://www.bbc.co.uk/worldservice/learningenglish/moving-words/shortlist/laotzu.shtml>. Accessed 12.01.2020.
- Bindra, V. 2017. Vivek Bindra explaining differences between vision and mission. Available: <https://www.youtube.com/watch?v=wpG-z95GsDI>. Accessed 04.01.2020.
- Burrows, M. Introducing Kanban through its Values. Available: <https://kanbantool.com/kanban-library/why-kanban/introducing-kanban-through-its-values>. Accessed 22.12.2019.
- Byrne, A. 2017. The Lean turn around. USA: McGraw-Hill Education.
- Centria UAS. 2020. Centria web page. Available: <https://web.centria.fi/en>. Accessed 05.01.2020.
- Charron, R., Harrington, H. J., Voehel, F. & Wiggin, H. 2015. The Lean Management Systems Handbook. New York: CRC Press. (Tayler & Francis Group).
- Crawford, M. 2016. 5 Lean Principles Every Engineer Should Know. Available: <https://www.asme.org/topics-resources/content/5-lean-principles-every-should-know>. Accessed 27.11.2019.
- Dennis, P. 2007. Lean Production Simplified. 2nd edition. New York: CRC Press.
- Do, D. 2017. The Five Principles of Lean. Available: <https://theleanway.net/The-Five-Principles-of-Lean>. Accessed 14.12.2019.
- Issuu. 2016. Central Ostrobothnia UAS- International Office. Available: https://issuu.com/couexchange/docs/centria_international_web. Accessed 27.11.2019.
- Kanbanize. 2020. Available: <https://kanbanize.com/kanban-resources/getting-started/what-is-kanban/>. Accessed 18.12.2019.
- Keski-Pohjanmaan ammattikorkeakoulu. 2002. Keski-Pohjanmaan ammattikorkeakoulu (Välähdyksiä). Kokkola: ArtPrint Oy.
- King, P. L. 2009. Lean for the Process Industries. New York: CRC Press.
- Kuisma, A. 2019. Implementing lean. Available: <https://www.theseus.fi/bitstream/handle/10024/81771/BIMaster-Thesis-ChithraPrabhaPeachiMuthu.pdf?sequence=1&isAllowed=y>. Accessed 13.12.2019.
- Majewski, M. 2017. 10 Benefits of Lean. Available: <https://blog.planview.com/10-benefits-of-lean/>. Accessed 28.12.2019.
- Martin, J. 2009. Lean Six Sigma for office. Florida: CRC Press (Taylor & Francis Group).
- Meiling, J. 2018. Kanban in Organisational Part I. Available: <https://www.projectwizards.net/en/blog/2018/11/kanban-organizations>. Accessed 18.12.2019.

- Meiling, J. 2019. Kanban in Organisational Part II Available: <https://www.projectwizards.net/en/blog/2019/01/kanban-corepractices>. Accessed 21.12.2019.
- Ministry of education and Culture. Available: <https://minedu.fi/en/current-issues> . Accessed 2.10.2019.
- Morgan, J. & Jones, M. B. 2012. Lean Six Sigma for Dummies. 2nd edition. England: John Wiley & Sons, Ltd.
- Pinto, L. 2010. Project Management. 2nd edition. New Jersey: Pearson Education.
- Roussel, J. 2014. 4 Principles of Kanban. Available: <https://blog.kainexus.com/improvement-disciplines/lean/kanban/4-principles> Accessed 28.12.2019.
- Skhmot, N. 2017. The 8 Wastes of Lean. Available: <https://theleanway.net/The-8-Wastes-of-Lean> Accessed 27.12.2019.
- Smartsheet. Everything you need to know about Kanban boards. Available: <https://www.smartsheet.com/visualize-your-do-list-using-kanban-boards-optimize-workflow>. Accessed 15.12.2019.
- Taghizadegan, S. 2006. Essentials of Lean Six Sigma. USA: Butterworth-Heinemann publications.
- Terry, A. & Smith, S. 2011. Build Lean. London: Hobbs the Printers.
- TKI Centria UAS. Available: <https://tki.centria.fi/rd-projects/digitalisation> Accessed 18.11.2019.
- Universities of Applied Sciences Act. Available: <https://www.finlex.fi/fi/laki/kaan-nokset/2014/en20140932.pdf> . Accessed 04.11.2019.
- Waterman, R. 1994. What American Does Right. New York: Plume.
- Web-Cab. Lean Manufacturing. Available: <https://www.web-cab.com/en/>. Accessed 07.12.2019.
- Womack, J. 2004. A Lean Walk Through History. Available: <https://www.lean.org/womack/DisplayObject.cfm?o=727> Accessed 26.11. 2019.
- Womack, P., Jones, T. & Roos, D. 1990. The Machine That Changed the World. New York. Macmillan Publishing Company.

Questions Presented to the employees of Centria Wood Laboratory

1. How would you introduce your personal and professional background?
2. What is your responsibility in Centria RDI?
3. Have you worked in the same field before this work?
4. What motivates/demotivates during your project?
5. What was your challenging project? How did you manage it?
6. How do you lead any project?
7. How do you communicate with your customers?
8. How do you plan your budget of your project?
9. What is your biggest mistake? How you recall it? What lesson you learned from it?
10. Differentiate between your first and last (ongoing) project?
11. What is your main problem?
12. How do you want your upcoming Kanban to be like?
13. What is your main priority during your project/task?
14. Do you use any project management software?
15. How do you evaluate either your project is in right track or not?
16. What is the first thing you do before starting your day?
17. What will be your reaction when there occurs unexpected problem in the project?
18. Do you accept every project/task offered to you?
19. Who are customers for you?
20. Normally how many tasks you can do in 1 week?

SWOT Analysis for Centria wood laboratory)

<p style="text-align: center;">Strengths</p> <ul style="list-style-type: none"> • Strong demand • Stable government (political support) • Funding • Collaborative power • A class quality service • Creative/ Innovative team • Popular management team • Strong brand • Project management skill • Speed delivery • Low risks process • Expertise in the related field • Price/ Value/Quantity 	<p style="text-align: center;">Weakness</p> <ul style="list-style-type: none"> • Difficult to find funding for big/small project • Horizon project are comparatively complex • Poor project management capabilities • Expertise/ Reputation • Poor communication (colleagues, co-partners, clients) • Procurement and supply chain management • Unrealistic timescales/ Deadlines (pressure) • Reliable data and project plan
<p style="text-align: center;">Opportunities</p> <ul style="list-style-type: none"> • Contribute to improve economy of the client and development of local region. • Protect environment by eliminating deteriorating factors • Increased reputation in the market • Potential for new project from governmental agencies and INGOS. • Expand to new geographical areas. • Enter in new market • Add new clients • Co-ordinate with new partners • Create employment opportunities • Innovational and technological development • Positive global influence • Business/Product/Service development. 	<p style="text-align: center;">Threats</p> <ul style="list-style-type: none"> • Political situations/ Legislative effect • Economic crisis • Limited funding • Opposition (people hate changes/difficult to adapt, start from zero) • New competitor • Existing competition expands • Creation of new product • Decreasing market demand • Increasing customer dissatisfaction • Bankruptcy of supplier/clients • Client dissatisfaction • Unexpected accidents (Loss of resources) • Innovation in technology, services and ideas • New contracts and partners

Design of task card

Task: Resource: Goal: DL: Week: Priority Num: Leader:	Task: Resource: Goal: DL: Week: Priority Num: Leader:	Task: Resource: Goal: DL: Week: Priority Num: Leader:
Task: Resource: Goal: DL: Week: Priority Num: Leader:	Task: Resource: Goal: DL: Week: Priority Num: Leader:	Task: Resource: Goal: DL: Week: Priority Num: Leader:
Task: Resource: Goal: DL: Week: Priority Num: Leader:	Task: Resource: Goal: DL: Week: Priority Num: Leader:	Task: Resource: Goal: DL: Week: Priority Num: Leader:
Task: Resource: Goal: DL: Week: Priority Num: Leader:	Task: Resource: Goal: DL: Week: Priority Num: Leader:	Task: Resource: Goal: DL: Week: Priority Num: Leader: