

# **Improving Business Performance of Company XXX by the Application of Lean Management Techniques**

Bc. Vladyslav Vlasov

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Master Thesis  
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 **Tomas Bata University in Zlín**  
Faculty of Management and Economics

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## **MASTER'S THESIS ASSIGNMENT**

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Degree, First Name and Surname: **Vladyslav Vlasov**  
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#### Introduction

#### I. Theoretical part

- Search the literature to discover the general principles of Lean Management.

#### II. Practical part

- Analyse the current performance of XXX in order to ascertain the main areas that could be treated by Lean techniques.
- Identify the relevant Lean techniques.
- Prepare a project of implementation of the relevant Lean techniques at XXX.

#### Conclusion

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prof. Dr. Ing. Drahomíra Pavelková  
*Dean*



Ing. Pavla Staňková, Ph.D.  
*Head of Department*

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## **ABSTRAKT**

V dnešní době, s pohledem na dynamický technologický pokrok a při zesílení konkurence na trhu, společnosti, jako nikdy předtím bojují o svou konkurenční schopnost. A proto jejich management musí být schopen nejen rychle reagovat na měnící se podmínky podnikání, ale taky myslet několik kroků dopředu. V této situaci využití Lean management - štíhlá výroba - může být považováno za další konkurenční výhodu. Lean management už prokázal svou účinnost a schopnost značně ovlivnit výkonnost výrobních společností. Na celém světě můžeme sledovat zvyšující se počet úspěšných zahajení Lean principů a technik do administrativních oblastí. Tyto skutečnosti vyvolávají lidi ke hloubšímu studování "štíhlého" konceptů. Současná práce si klade za cíl nastínit základy konceptu Lean, jejich principů, technik a nástrojů, které organizace mohou používat ve svých administrativních procesech. Základem je systematický přehled literatury a další doporučení a návrhy použití Lean metody. Výsledkem práce bude vzniklý model pro zavedení procesu Lean Office v Metinvest, plán tréninku metody štíhlé výroby pro personál organizace a podrobné příklady praktického využití takových Lean nástrojů, jako jsou mapování toku hodnot a 5S System v pracovním prostředí.

**Klíčová slova:** Lean management, strategie, mapování toku hodnot, zlepšování procesů, 5S System

## **ABSTRACT**

Today, in the reality of dynamic technological advance and intensified market competition, companies, as never before, struggle to remain competitive. Therefore their management has to be able not only to respond quickly to the changing conditions of conducting business, but think a few steps ahead. In this situation, the utilization of Lean can be considered as an additional competitive advantage. Lean has already proven its effectiveness and ability to significantly influence the business performance of manufacturing companies. An increasing number of successful implementations of Lean principles and techniques into administrative areas can be found around the globe. These facts induce people to study the Lean concept more deeply.

This work outlines the fundamentals of Lean, its principles, techniques and tools which can be applied in the administrative processes of organisations. It is based on a systematic review of the literature and further recommendations and suggestions on Lean utilization. The outcomes of the work include a developed model for introducing a Lean Office process in Metinvest, a plan for Lean training of the company personnel and detailed examples of the practical use of such Lean tools as value stream mapping and 5S System in the office environment.

**Key words:** Lean management, strategy, value stream mapping, process improvement, 5S System

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Zlin, Czech Republic, May 2<sup>nd</sup>, 2013

Vladyslav Vlasov



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## INTRODUCTION

Constantly increasing global competition and market dynamics force companies from all over the world to seek ways of improving the quality of their products and services in order to be able to better satisfy existing customers and attract new ones, thus becoming more profitable. There are various techniques and strategies that can help to achieve this objective. One very effective way is to exactly define the term 'customer value', in other words what they are willing to pay for, and when exactly it is delivered. After this is done, companies can concentrate on reducing the time when no value is added to the final product or service.

Many would say that this is what Lean is about and they would be right, but just partly. This is indeed an integral part of Lean: to determine non-value adding processes, then minimise or at best eliminate them through the application of specific tools and methods. However, Lean goes far beyond just tools or techniques, it is much more about the way of thinking and doing business.

It is not an easy process to become Lean. Lean has to be integrated not only on a shop floor or office environment, but into corporate strategy and culture of any organisation aiming at continuous business improvements as well. The implementation of a number of Lean tools can result in temporary changes to better, but an overall Lean transformation can considerably change the performance of a company at each level in a long-term perspective. Initially coming from Toyota manufacturing plants, Lean has evolved into a management approach and today is being applied in various non-manufacturing spheres including healthcare, legal services, accounting, information technologies, etc.

The main objective of this work is to study various literature sources such as monographs, bibliographies, scientific articles and researches related to the Lean concept to discover which tools and techniques can be utilised in an administrative environment and come up with suggestions on their implementation.

The master's thesis consists of two main parts: theoretical and analytical. The first part deals with the theoretical background of Lean. It addresses such issues as historical insight into the topic; description of what Lean is with a help of "The Lean Thinking House" developed by Larman and Vodde, 2009; the application of Lean in non-

production areas with examples of successful implementations and an overview of Lean application in office environment.

The analytical part begins with a brief introduction of the Metinvest Company. Next, a model for introducing Lean offices within the company is suggested. It summarises the key strategies required to create the skills, knowledge and application capability within Metinvest to start establishing an in-house capability to sustain Lean in the future. The model is followed by a training plan that is aimed at helping Metinvest to start the implementation of Lean in their offices. Step-by-step processes of applying such Lean tools as value stream map and 5S System conclude the thesis.

The conclusion sum ups the results of the work and gives a final review of the suggestion on how the business performance of the company can be improved through the application of Lean management techniques.

## **I. THEORY**

## 1 HISTORY OF LEAN

The end of the 20<sup>th</sup> and the beginning of the 21<sup>st</sup> centuries saw a significant increase in the interest in Lean manufacturing which was considered to be the core of success of many companies (with Toyota in the first place). Lean tools and principles, benefits of Lean, examples of application of Lean techniques in other spheres than manufacturing and Lean thinking have been deeply studied and produced many books and research articles in this field.

The following sections will cover history of Lean from its starting stage until present days, give a general insight into Lean and its application in the modern world.

### 1.1 Evolution of Lean

The historical background of Lean dates back to Frederick Taylor who introduced the basic management tools of mass production. In the 1920s, Henry Ford implemented many revolutionary manufacturing tools such as moving assembly lines and interchangeable parts.

After World War II Japanese manufactures were faced with such problems as vast shortages of material, financial, and human resources. These problems made the competition with the Western counterparts tougher. In the mid-1940's American car makers were outperforming their Japanese competitors by a factor of ten. These conditions resulted in the appearance of the "Lean" manufacturing concept. Toyota Kiichiro, Shigeo Shingo, and Taichii Ohno and other engineers in Toyota studied the system that was developed by Henry Ford and devised a new process-oriented Lean management system. It was later described in a book the "Toyota Production System: Beyond Large Scale Production" by Taichii Ohno. Initially the book was published in 1978 in Japanese and 10 years after in English (Ohno, 1988). Given the fact that he was responsible for developing a system that had to improve productivity at Toyota, Ohno is considered to be a main force behind this system. Toyota Production System (TPS) in essence shifted the focus of the manufacturing engineer from individual machines and their utilization, to the flow of the product through the total process. According to Ohno (1988), the primary goal of TPS is to eliminate waste and produce only the items needed at the required time and in the required quantities with the highest possible value.

TPS was the next major evolution in efficient business processes after the mass production system invented by Henry Ford. As a result, the late 1980's saw the rise of Japan as a manufacturing nation, and also prestigious Japanese corporations began to establish manufacturing and assembly facilities in North America and Europe. These companies included Toyota, Nissan, and Honda, Sony, Panasonic and a legion of other Japanese firms that few people had heard of but were exemplar companies in their chosen product sector. *The Machine that Changed the World* by Womack, Jones and Roos (1990) provided the first data coming from the automotive industry for Western manufacturers, that Japanese manufacturers had a 2:1 productivity and a 100:1 quality advantage over the West. These gaps were huge and clearly showed that Japanese manufacturers achieved them due to excellent levels of quality performance and great supply chain management (Rich et al., 2006).

Rich et al., (2006) attribute that this rapid rise, from nowhere, to become one of the world's centres for manufacturing excellence, set in place a quest to find out how these companies designed and operated their manufacturing systems to achieve such competitive advantage. This process was to yield a new and post-mass production model of manufacturing that has been termed 'Lean production' and more recently evolved in 'Lean thinking'.

At this point of time, Western manufacturers realized that the traditional mass production concept had to be adapted to the ideas of Lean manufacturing. In the 1980s, the first investigations about TPS were made in North America. In 1984, NUMMI (New United Motor Manufacturing Inc.), a joint venture between Toyota and GM was opened in California. International Motor Vehicle Program (IMVP), a five year study at Massachusetts Institute of Technology (MIT), was conducted to analyze the performance gap between Japanese and Western auto industries. These two important events increased the interest in TPS in North America (Womack et al., 1990). In 1988, John Krafcik, a researcher at MIT, coined the term "Lean" to describe the TPS.

The automotive industry has emulated the Lean approach of Toyota, but also other industries began to take an interest in the 'Lean approach' for their own market sector. Western businesses began to experiment and implement Lean methods and to make improvements. This fact attracted attention of Jim Womack and Dan Jones, founders of the Lean Enterprise Institute and the Lean Enterprise Academy (UK), respectively, and resulted in the publication *Lean Thinking* in 1996. This publication followed the



progress of 52 Western cases of attempts to redesign the operations and become 'Lean producers'. This study proved that 'Lean production' can be transferred for Western businesses and it is not culturally specific to Japan (Rich et al., 2006).

Currently, Toyota, the leading Lean exemplar in the world, has become the largest automaker in the world in terms of overall sales. Its dominant success in everything from rising sales and market shares in every global market, not to mention a clear lead in hybrid technology, stands as the strongest proof of the power of Lean enterprise (Shook, 2010).

This continued success has over the past two decades created an enormous demand for greater knowledge about Lean thinking.

As Lean thinking continues to spread around the world, leaders are also adapting the tools and principles beyond production, to logistics and distribution, services, retail, healthcare, construction, maintenance, and even government. Indeed, Lean consciousness and methods are only beginning to take root among senior managers and leaders in all sectors today (Shook, 2010).

## 2 LEAN OVERVIEW

This section starts with a short introduction to Lean and continues discovering it through a Lean Thinking House describing each block of it in detail.

### 2.1 Introduction to Lean

As it has been mentioned in the previous section, the term ‘Lean’ was used to describe Toyota's way of doing business in the late 1980s by John Krafcik, a member of research team headed by Jim Womack, Ph.D., at MIT's International Motor Vehicle Program.

The traditional belief in the west had been that the only way to make profit is to add it to the manufacturing cost in order to come up with a desired selling price. The Japanese approach believes that customers are the generator of the selling prices. The more quality one builds into the product, and the more service one offers, the more price the customer will pay. The difference between the cost of the product and the price is what determines the profit (Ohno, 1997; Monden, 1998).

The primary idea of Lean practices is to maximize customer value while minimizing or eliminating waste. In other words Lean means creating higher value for customers with less resources.

The main goal of any organisation that utilises Lean in its operations, is to provide perfect value to the customer through a perfect value creation process which has zero waste. From the customer's perspective, value is anything that the customer is willing to pay for in a product or the service (Womack et al., 1998).

According to Womack et al. (1998), to achieve this goal, the whole organisation should become Lean, and start thinking in a Lean way. Lean thinking changes the focus of management from optimizing separate technologies, assets, and vertical departments to optimizing the flow of products and services through entire value streams that flow horizontally across technologies, assets, and departments to customers.

To create processes that need less human effort, less space, less capital, and less time to make products and services at much lower costs and with far less defects, compared with traditional business systems, it is necessary to eliminate waste (or “muda“, waste in Japanese) through whole value streams, and not just at isolated points. Companies are

able to adopt to changing customer desires with high variety, high quality, low cost, and with very fast throughput times. Also, information management becomes much simpler and more accurate (Shook, 2010).

Lean is not a tactic or short term cost reduction program, but a way of thinking and acting for an entire organization. The Lean transformation is often used to characterize a company moving from an old way of thinking to Lean thinking. It requires a complete transformation of the company's way of conducting business. This takes long-term perspective and perseverance (Jones, 2010).

## 2.2 The Lean Thinking House

The general idea of Lean has been described in the previous paragraphs and now it is possible to go deeper and analyse the basics of Lean thinking.

Toyota's president, Gary Convis, mentions two pillars of Lean: ***Continuous Improvement*** and ***Respect for People***. Continuous improvement (kaizen in Japanese) is derived from the Toyota's approach to business and calls upon to "Challenge everything". Convis says,

*"More important than the actual improvements that individuals contribute, the true value of continuous improvement is in creating an atmosphere of continuous learning and an environment that not only accepts, but actually embraces change"*

However, without respect for people it is not possible to create such kind of environment. That is why it is the second pillar of Lean. In Toyota, people mean employees, supply partners, customers, and everyone engaged into the business.

Companies which decide to adopt Lean tools cannot do it without the transformation to a Lean state of mind and behaviour of both management and regular employees. Otherwise the essential understanding and conditions for sustainable success with Lean will be missing.

Figure 1 depicts "The Lean Thinking House" diagram that is a summary of the modern Toyota Way. The first version of Toyota system was summarised in a form of a similar house diagram by Fujio Cho in 1973 and who later became Toyota's chairman.



**Figure 1:** The Lean Thinking House (Leffingwell, 2009)

"The Lean Thinking House" presented above is an adapted version from Larman and Vodde (2009). Their "house" is built of such blocks as Goal, Foundation, Pillar 1, Pillar 2, 14 Lean Principles and Development Practices. A closer look at each of 4 blocks and 2 pillars is provided below.

### 2.2.1 Block 1. The Goal: Value.

(Sustainable shortest lead time. Best quality and value (to people and society). Most customer delight, lowest cost, high morale, safety.)

The main idea of Lean is to increase value and deliver it both to the customer and to society by using the shortest possible cycle times for every process, producing work of the highest quality and minimising delays. Taiichi Ohno (1988), the creator of TPS emphasized that it was necessary to look at the whole time-line, from the moment when the customer made an order to the moment the cash is collected. He also stated that the

time-line should be reduced by minimizing non-value-adding wastes. Larman and Vodde (2009) explained Ohon's idea in a following way:

*"A focus of Lean is on the baton, not the runners—removing the bottlenecks to faster throughput of value to customers rather than locally optimizing by trying to maximize utilization of workers or machines."*

This example makes it easier to understand how to achieve the main goal of Lean.

### **2.2.2 Block 2. Foundation: Management Support.**

(Management applies and teaches Lean thinking, and bases decisions on this long term philosophy.)

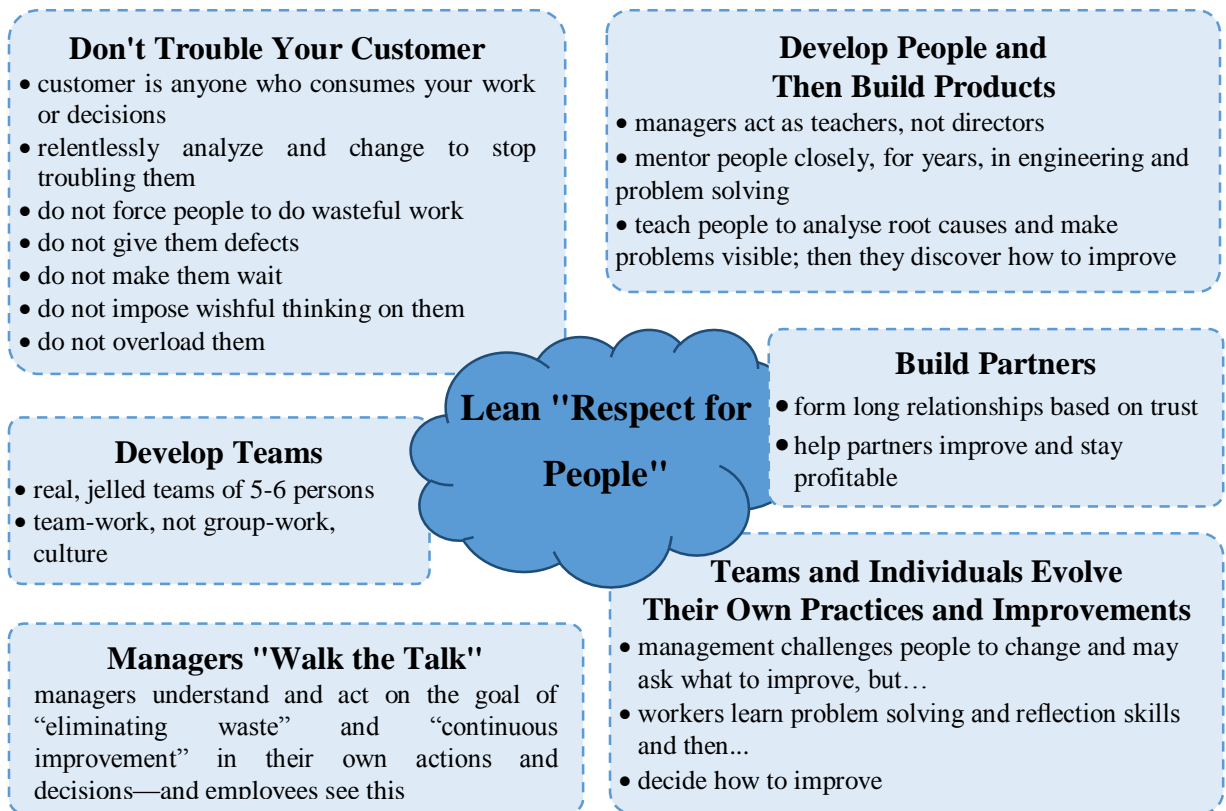
Before starting work, Toyota's new employees spend several months on education. A significant part of this time is devoted to teach newcomers the foundations of Lean thinking, how it is applied in different domains, how to see "waste" and make them appreciate the corporate culture. It is very important that employees have a "Lean" mind-set from the very beginning of their work (Shook, 2010).

From the experience of Toyota, managers should work their way up over years of hands-on Lean thinking practice and later help and mentor others. Managers have to train people on how to think Lean. They should be teachers of thinking skills based on their own experience. These management practices are very important for the successful adoption of Lean. Managers of all levels must clearly understand Lean principles, work with them and teach to others. Managers when they come across some problem have to study it very deeply and not only solve it, but also understand its root causes. Only in this way the highest quality can be achieved. Managers are expected to be hands-on specialists in their work so that workers know that manager can do the job better and that these persons deserve to be managers (Larman and Vodde, 2009).

So, the foundation of Lean is not tools or waste reduction, but is the manager-teachers that live Lean, teach Lean, and have a huge hands-on experience.

### 2.2.3 Pillar 1 – Respect for People

Respect for People does not sound very clear and even nebulous, but it implies a set of concrete actions and a specific culture which reflect sensitivity and respect for morale. People should not do wasteful work, they should work as a team, they should get help and also play role of a mentor when possible to develop skilful employees.



**Figure 2:** Lean "Respect for People" (Larman and Vodde, 2009)

Figure 2 illustrates some examples of Respect for People. These are some most important implications of Respect for People that can be utilised by many companies all over the world. If a company is interested in improving its corporate culture and Respect for People in particular, there are many more methods of doing it which are specific to each organisation. However, not every practice can be applied in every company.

### 2.2.3 Pillar 2 – Continuous Improvement

(Go See, kaizen and perfection challenge form the basis of Continuous Improvement.)

A description of each idea is provided below:

- Go See for Yourself (Go See)

Go See is a fundamental and critical principle of Lean management culture. It is considered as the number one factor for successful continuous improvement. All people, and, most importantly, managers, in a Lean-thinking culture should not spend their whole working day in a private office or meeting room or getting to know about everything happening in a company through reports. Management should visit the places of real work, see it and understand it better. Better understanding and personal presence help to find ways to solve problems and opportunities to improve. Nanpachi Hayashi (2008), Toyota's top engineer, in an interview on How to Develop Thinking People mentioned a saying of Taiichi Ohno:

*"Don't look with your eyes, look with your feet. Don't think with your head, think with your hands. People who can't understand numbers are useless. However, people who only look at the numbers are the worst of all"*

Nowadays very few companies pay attention to this ideas, there are plenty of cases when managers work just in their offices without knowing what is going on a shop floor. One may say that they still manage to achieve good results; however, those managers who spend more time at the real place of value work tend to achieve much better results.

- Kaizen

In some works Kaizen is simply translated as a "continuous improvement", but thus it can be confused with the "continuous improvement" pillar of Lean. *Kai + zen* means "to take apart" and "to make good". Larman and Vodde (2009) include kaizen into the "continuous improvement" pillar of The Lean Thinking House. Kaizen is not only practice, but also a personal mind-set. The mind-set suggest that workers have both to do their work and also improve it. As for the practical side of Kaizen, it is about choosing and applying particular techniques which should lead to improvements. An individual or a team are not able to realize if there is a need to improve or change some practice until they clearly understand its basics and can do it properly. Improvement practices or Kaizen events consist of such steps as:

1. Analysis of a particular current situation until it is well-understood.
2. Work out experiments leading to improvements.

The advice of Kaizen specialists is not to work on many improvements at once, but rather focus on one process and do it well. A big advantage of Kaizen is that improvements can be achieved in few days via intensive workshops. Tools such as 'Five Whys' are commonly used during such workshops.

**Five Whys** (often written as 5 Whys). This is an easy-to-use tool that helps people develop a root cause analysis and problem solving skills. In case of some problems, a team should ask "why" it is so at least 5 times. The answers can be presented in a form of a "5 Whys graph" or a better structured *fishbone (Ishikawa) diagram*. This method makes people dig deeper into the roots of a problem (Bulsuk 2009).

As an example, let us assume the assembly line stops.

WHY did the assembly line stop - BECAUSE part X was not there

WHY was part X not there - BECAUSE it was not processed

WHY was it not processed - BECAUSE the processing machine broke down

WHY did the processing machine break down - BECAUSE it was not maintained

WHY was the machine not maintained - BECAUSE there is no maintenance schedule

This is the root cause of the problem. Therefore strict maintenance schedules must be put in place and followed.

Womack et al (2003) adds that Kaizen means a change for the better and can refer both to very large changes and small, incremental changes. Western firms tend to focus on breakthrough innovation and are weak at continuously improving in small amounts, This has been the focus of teaching kaizen to Western firms.

- Perfection challenge

This is one more element of continuous improvement in Lean. There are companies that are doing their business well, are satisfied with their performance and find it unnecessary to change their well-established processes. These companies do not take seriously strong competition and one day may realize that their performances are not as good as they think because others are now doing better. The kaizen mind-set is about having high expectations and challenging everything: ourselves, members of teams, partners, levels of skills, etc. This should be an integral part of company's culture (Larman and Vodde, 2009).



In companies with a Lean thinking, the improvement cycles should be repeated forever as a never-ending search for perfection.

**2.2.4 Block 3. 14 Lean Principles from Toyota**

The 14 Lean Principles described below constitute the Toyota Way and are a part of the overall system of Lean. They are still being used at Toyota and can help to understand and develop a Lean culture.

Table 1 is a summary of the 14 Principles of the Toyota Way.

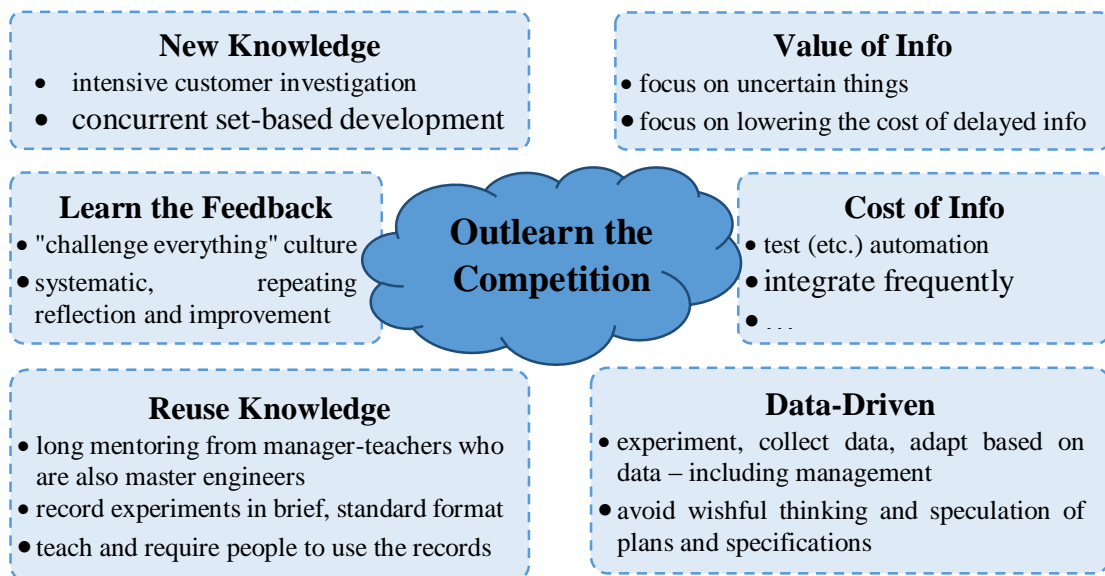
**Table 1:** 14 Lean Principles (Liker, 2003)

<b>I. Having a long-term philosophy that drives a long-term approach to building a learning organization</b>	
1.	Base your management decisions on a long-term philosophy, even at the expense of short-term financial goals
<b>II. The right process will produce the right results</b>	
2.	Create a continuous process flow to bring problems to the surface
3.	Use "pull" systems to avoid overproduction
4.	Level out the workload ( <i>heijunka</i> ). (Work like the tortoise, not the hare)
5.	Build a culture of stopping to fix problems, to get quality right the first time
6.	Standardized tasks and processes are the foundation for continuous improvement and employee empowerment
7.	Use visual control so no problems are hidden
8.	Use only reliable, thoroughly tested technology that serves your people and processes
<b>III. Add value to the organization by developing its people and partners</b>	
9.	Grow leaders who thoroughly understand the work, live the philosophy, and teach it to others
10.	Develop exceptional people and teams who follow your company's philosophy
11.	Respect your extended network of partners and suppliers by challenging them and helping them improve
<b>IV. Continuously solving root problems to drive organizational learning</b>	
12.	Go and see for yourself to thoroughly understand the situation ( <i>Genchi Genbutsu</i> )
13.	Make decisions slowly by consensus, thoroughly considering all options; implement decisions rapidly ( <i>Nemawashi</i> ).
14.	Become a learning organization through relentless reflection ( <i>hansei</i> ) and <i>Kaizen</i> .

These 14 principles should not only be well-known by every member of the company that is implementing Lean, but also kept in mind when making any decision or doing any work. Liker, 2003 finds that when it is possible to follow only a few of the Toyota Way principles, the result will be just short-term improvements. Even more important is not to blindly imitate tools used by Toyota, but develop principles that are appropriate and right for your company, practice them in order to achieve higher performance and add value both to customers and society. The ‘Principles of Toyota’ are a very good starting point.

### 2.2.5 Block 4. Development Practices

Lean Product Development's (LPD) main focus is on learning and creating more useful knowledge compared to the competition. Larman and Vodde call it to ‘outlearning the competition’. Figure 3 contains advice on how a company can outlearn the competition with LPD.



**Figure 3:** How to Outlearn the Competition (Larman and Vodde, 2009)

To conclude, Lean thinking is a broad system that covers all the functions of an enterprise. It is much more than just tools and to yield good results, it should be shared by workers and managers of all levels.

### 2.3 Waste in the Context of Lean

In the previous sections of this chapter, waste elimination was often mentioned and its importance for increasing 'value'. Ohno (1988) defined a set of "wastes" known as "the seven wastes". At Toyota these wastes were formulated as a fixed list that allowed worker to identify weak points in workplace management. In this context, waste is everything that adds cost and no value to the final good. (Rich et al, 2006)

**Table 2:** Toyota Seven Wastes (Rich et al, 2006)

<b>№</b>	<b>Type of waste</b>	<b>Description</b>
1	Overproduction	Vast amounts of products are made in batches and simply 'dumped' into finished goods or work-in-process.
2	Unnecessary inventory	It is a result of overproduction and inventory is simply held awaiting an order in the belief that future orders will come.
3	Inappropriate processing	Mismatch between the processes needed to make a product and the processes that are in place.
4	Unnecessary transportation	Movement of materials around a factory from the receiving bay to the shipping bay that consumes too much time and resources.
5	Unnecessary delay	Simple 'dwelling' time as products are ready to be converted, but sit waiting
6	Unnecessary defects	Production of materials (that consumes value adding time) but have to be reworked or scrapped.
7	Unnecessary motion	Production process is poorly designed and operators engage in stressful activities to handle materials (bad ergonomics of the working places).

To make any Lean change programme work, it is important to communicate the knowledge of what is value and what is waste. So the first step for future Lean activities is to make clear the difference between value, what a company does, what customer is ready to pay, waste and cost. These wastes come from manufacturing and production, but it is also possible to apply them in other spheres of business than the shop floor, e.g. the office environment.

### 3 LEAN APPLICATIONS

Previously, Lean was only associated with and referred to manufacturing. This popular misunderstanding does not exist today. Much research has been done and many publications exist on how Lean can be applied in nonproduction processes.

It is important to remember that Lean is much more than just tools and techniques. The thinking behind these tools is just as important. Womack and Jones (2003) recommend to think carefully about 3 fundamental business issues which guide the Lean transformation of a whole organization: Purpose, Process, and People. Richardson (2012) adds one more issue – Problems. He proposed to ask 4 questions every time people say Lean is just for production:

1. Do you have a PURPOSE for your organization?
2. Do you have PEOPLE in your organization?
3. Do you have PROCESSES that create some type of output or service in your organization?
4. Do you have PROBLEMS within your organization?

If all answers are positive then organisation can implement Lean. It is very rare that the answer to any of these questions is no.

Purpose provides an organisation with a direction and helps to analyse what a company should do to achieve its objective of prospering.

People. From year to year, many companies claim that the most important asset for them are people. It is really true. Every business depends on its employees. In a Lean system they are a key to long-term success. Those who are promoted to management have to spend a considerable part of the working time to develop other workers.

Process. When there is an output created, then there is a process involved. The way company assesses each value stream to be sure each process is valuable, flexible, available, capable and adequate is also a process. Managers have to document every process and standardize them so people can understand them better and find weak points faster. Standardised Operations make it easier for other workers to take over in times of need. Most workers should have three skills

and each skill should have three workers available. Every process should be mastered through many repetitions, after being mastered it should be maintained for some time and afterwards improved.

Problems. When problems within an organisation can be recognised at a glance, such organisations are far ahead of others. To explain a problem, facts are needed, not assumptions. Standards help to see if something is abnormal or wrong. If an organisation has standards, then problems are the gap between the standard and the abnormal state.

To conclude, Lean is not only a manufacturing-based methodology, it can be utilized by any organization. Nowadays, businesses in all industries and services, including healthcare and governments, are using Lean in the way they think and do.

Some examples of applying Lean in non-production spheres are:

- *Construction*. Lean construction is a mix of development techniques and research in the field of construction connected with continuous improvements of dimensions such as the built and natural environment: construction, design, maintenance and recycling, (Abdelhamid et al. 2008).
- *Information Technology (IT)*. Lean IT empowers the company's 'agility' i.e. provides an opportunity to deliver more value to the customer and get a competitive advantage utilizing cutting-edge capability of IT.
- *Accounting*. Lean accounting supports Lean manufacturing, Lean logistics, Lean product design and other processes. It improves decision-making process by providing understandable and accurate information, saving money and time.
- *Higher Education*. There is a huge amount of waste in academic and administration activities: admission procedures, advising, student services, degree programs, and other aspects of higher education that can be reduced or even eliminated. Moreover, if all students go through a short course on Lean Thinking, they will be able to apply it both in their day-to-day life and at work. It can make them considerably more efficient and more valued by company management.
- *Health Care*. Application of Lean in healthcare organisations has a great impact on cost, time, quality, staff and customer satisfaction. Lean projects in healthcare have become widespread: Brandao de Souza (2009) show that most have

occurred in the USA (57%), with the UK growing at a fast pace (29%), followed by Australia at 4%. Many of the results have been in terms of tangible outputs such as waiting times reduction, quality increase through a reduction of errors, as well as intangibles ones such as increased employee motivation and increased customer satisfaction (Radnor and Boaden, 2008).

- *Government.* Governments have been utilizing Lean because it helps them to increase the value added. Cutting out inefficiency and waste from governmental organisations results in better services. U.S. government agencies use Lean to improve transparency, speed and quality of processes, e.g. U.S. Environmental Protection Agency, U.S. Department of Agriculture, U.S. Department of Defense and others.
- *Call Centres.* Call centres form a large industry, in the USA over 55 000 call centres employ about 2.9 million agents, in the UK around 600 000 agents work in more than 6000 call centres (Getty, 2009). Lean can bring the following benefits to this sector: decrease number of lost calls, better utilization of technology and human resource, reduce employees' turnover (agents experience a lot of stress due to the pace of the work and a more streamlined operations could assist in decreasing the stress) (Jiju, 2010).
- *Lean Office.* The administrative area or office is another opportunity where Lean can be implemented as far as many processes can be standardized and the volume of waste, non-value adding activities, is much bigger compared to manufacturing. The Application of Lean into an office environment will be examined in detail in the following chapter.

## 4 LEAN ADMINISTRATION

Every company strives to decrease its costs in every business aspect. At first, new principles were used in manufacturing, but more than 60% of the costs come from such administrative processes as (Tapping and Dunn, 2006):

- reception of an order from client;
- submission of an invoice;
- filling in contracts, application, other documents.;
- recruitment of a employees;
- preparation of reports;
- other processes.

A considerable part of organisations' potential cost savings would not be considered if the Lean focus stuck to only manufacturing processes. In a manufacturing environment, workers are often accustomed to an emphasis on improving efficiency and productivity. In non-manufacturing environments, there are employees who do not know what productivity is and may never have heard of “Lean” in this context (Tapping and Dunn, 2006).

Office employees are rarely challenged to think whether their jobs are efficient as it is typically not connected to the product's direct cost. But this is where the waste is. Processes in office are often laden with effort- or time-wasting activities. If these processes are streamlined and kept focused on a customer, the bottom line of any organisation can be positively affected. Still many managers and companies regard the idea of a Lean office programme with resistance. This happens because many employees have never had the authority or the opportunity to make a change. Any Lean event brings the idea of change and creates a supportive environment for problem solving and collaboration (Huls, 2005).

The Lean office has become very popular nowadays because companies look for any method to get any advantage and decrease costs so as to win in a competitive marketplace. The Lean office does the same for administrative processes what Lean manufacturing does for production, it reduces waste and improves flow. After Lean reduced costs on a shop floor, office costs accounted for a growing percentage. That is why many leaders came to an idea of Lean office to decrease costs further. Numerous

tools, methods, and techniques coming from Lean manufacturing can be smoothly translated to office settings while others have to be adjusted and modified (e.g. tact time, standard work, value stream mapping (VSM), etc.) (Basu, 2009).

The Lean office concept is very young and it is still developing and growing. The majority of Lean office practitioners started their Lean way in manufacturing, and later modified the knowledge to be applicable in office. The Lean office evolution sees more Lean specialists focusing on specific industries. They build customized sets of tool to be used in office environment of healthcare establishments, retail, public sector, banking, etc.

One way to decide whether a company needs Lean in the office or not was proposed by Huls (2005). Management should answer the following questions:

1. Is overtime common?
2. Are employees stressed?
3. Do decisions tend to be “political”?
4. Do employees complain about bureaucracy?
5. Is rework a fact of life?
6. Do employees spend a lot of time compiling, copying, and filing paperwork?
7. Is there more than one way to perform a task? Is one way better than another?
8. Do employees spend time searching for files, messages, or packages?
9. Has the company grown without changing processes?
10. Have little fixes been applied to areas that were broken?

If management answers YES to any of these questions, it could be said with a high probability that the organisation could benefit from a Lean office program.

There are 5 more questions to be asked:

1. Do you have standardized procedures?
2. Do you implement best practices?
3. Does every process have an owner?
4. Do employees understand how their role affects a process?



5. Do people communicate the right information at the right time to the right people?

If management answer NO to any of these 5 questions, Huls (2005) strongly recommends to consider a Lean office program.

A uniform model or template of a Lean office does not exist. It varies from company to company. Companies create their own specific Lean administrative systems depending on their situational needs, requirements and constraints. A number of Lean tools that can help to solve problems in office are presented in table 3.

**Table 3:** Key Lean Office Tools (California Manufacturing Technology Consulting, 2006)

<b>Tool</b>	<b>Description</b>
Value Stream Mapping	Illustrate current and future states
Kaizen	Process improvement events
Standard Work	The best practice for everyone
Mistake Proofing	Work Aids to prevent errors
Documents Tagging	Captures work elements in a process
5S	Reduces waste
Pull System	Paces work to customer's need
Office Layout	Organizes work space
Workload Balancing	Provides smooth flow of work

A brief overlook of some above mentioned Lean tools in office context is given below.

#### **4.1 Office Value Stream Mapping**

Value Stream Management deals with understanding, measuring and improving the interconnections and flow of every task accomplished to keep the service, quality and cost of outcomes on a competitive level. Value stream mapping is a basic tool of Value Stream Management that identifies opportunities of enhancing value, minimizing or eliminating waste and improving flow. It allows an organisation to document, measure, and conduct analysis of complex business processes.

*The objective of value stream mapping* – to assist management of a company in visualizing and communicating the way company acts today and recommend how it should act in future to influence the cost, service, and quality of its products and services (Keyte and Locher, 2004).

The office value stream is a set of activities supporting the everyday manufacturing needs of an enterprise. It includes not only processes which create value, but also those that add no value and are needed to complete the product (Locher, 2011).

There are several differences in value stream mapping at the shop floor and in office. Material flow in the office is a real flow of data that can be on paper or in an electronic format to finish a service. Information flow is a sequencing or a scheduling mechanism that gives a signal to start the next task. It occurs in offices as well as in production. Information flows within office are often poorly structured and do not use formal scheduling, which complicates the process of value streams' identification and mapping. Moreover, administrative departments usually deal with more than one value stream and thus it is more complicated to document flows of individual value streams, e.g. a customer service department can be involved in order entry, quoting, invoicing and telemarketing (Keyte and Locher, 2004).

Another important task is to distinguish between information management, that is about managing paperwork in supporting processes (order processing) and information flow, that refers to signaling a process or a person to do work.

At the first stage of bringing Value Stream Management to the office, Locher (2011) recommends to start with identification and redesign of a few value streams and adding more after it works well. To map a shop floor, a cross-functional team follows the path of a product by drawing a visual representation of the observations. In an office, service is usually the basis of most mapping observations. Teams map information flow, tasks, and performance of every service tasks. At the next step, they try to challenge the current state of the value stream and come up with a new future state with increased value, improved flow and reduced waste. The more company uses value streams, the more experience the personnel acquires and it becomes easier to find waste and increase value. Some people confuse VSM with process mapping. Value stream mapping has to focus on a straight-line series of activities, or steps. As well as process mapping, it can help

companies to decide on priorities and problem areas. Both of them may be used in parallel to describe the current way of working (Dean, 2010).

Dalco Metals is an example of a successful Value Stream Management. The value stream map made at Dalco Metals revealed that it was taking more time to process all required paperwork for an order than to manufacture the order itself. Dalco Metals completely rearranged their office space and grouped employees around the flow of the work, and not in departments. Due to this and other changes processing time decreased from 4 to just 2 days (Ring, 2010).

## 4.2 Waste in Office Environment

When implementing Lean, many manufacturers focus on achieving a 35-40% gain in productivity over four to five years. A Toyota consultant said companies have to focus on about 400% productivity improvement in 10 years to be on the path of becoming Lean. The 360% gap appears because of focusing on using Lean principles only on the shop floor. Huge potential for enterprise's productivity improvement is hidden off the shop floor in non-manufacturing areas (Keyte, 2009).

Identifying waste is a difficult task, but convincing other co-workers that a lot of waste can be found around them is a serious challenge too. Management may have to tell employees that a lot of work they do is wasteful. This has to be handled carefully and people should realize that it is not their individual fault, but a problem of the current system (Rich et al., 2006).

## 4.3 The 5S System – Orderliness and Cleanliness

5S is a visually-oriented method for organising a workplace developed by Hiroyuki Hirano (1995). This is an easy to implement tool that helps to bring employees together and create an atmosphere of improvement. Each letter "S" is a Japanese word and a name of 5 steps to organize and sustain an efficient working environment:

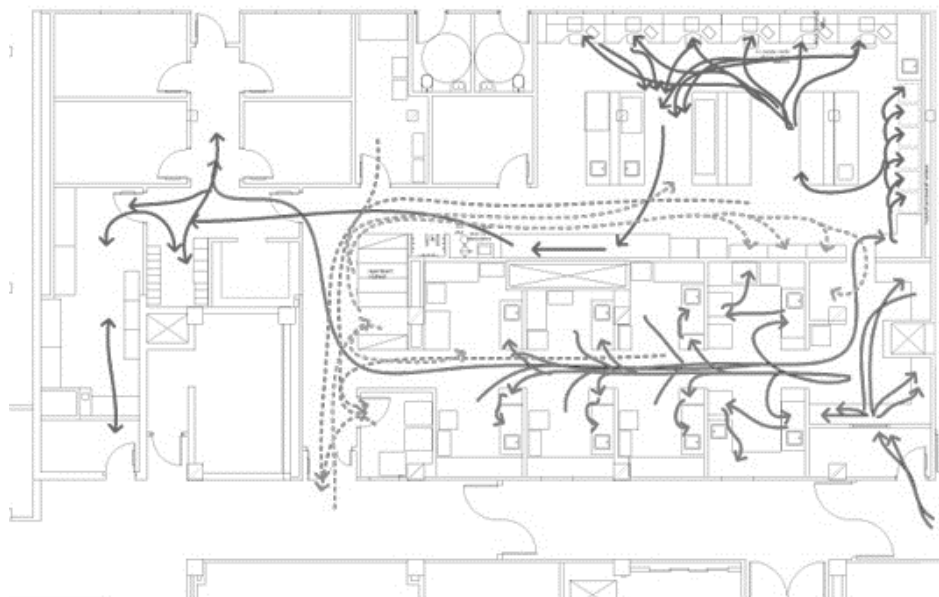
1. *Seiri* (Sort) – eliminate all unnecessary items from the working area.
2. *Seiton* (Straighten) – organize things in order and designate a visible, clearly marked place.

3. *Seiso* (Shine or Scrub) – work area should be incredibly clean.
4. *Seiketsu* (Standardize) – create standards for the steps 1, 2, 3 to preserve them easily.
5. *Shitsuke* (Sustain) – maintain steps 1, 2, 3, 4 to make 5S and an integral part of the organisations culture and extend it to other areas.

People work better in a clean and well-organised environment and are able to produce more value with less time (Fabrizio and Tapping, 2006).

#### 4.4 Office Layout

Minor changes can be used in office layout such as changing locations of often used tools to decrease unnecessary motion, for example, copier or printer locations, and departments' locations. Front offices are mainly organised by function; customer service, purchasing and engineering departments. It is not optimal for Value Stream Management. People organised in cross-functional teams and located in work cells can considerably improve efficiency, while the team has a clear vision of the overall process and does not focus on a single task. Spaghetti Chart (SC) is often used to show information and work flow (Marchwinski et al., 2008).



**Figure 4:** Improved Spaghetti Chart of Work Flow in Office (Moryttland Planning and Design)

The Spaghetti Chart is a diagram of a path taken by a product or set of activities along a value stream. It helps to analyse current office layout and come up with improvements. Fig.4 is an example of a Spaghetti chart of a work flow after revision and adjustments.

## 4.5 Standard Work

There are numerous opportunities of standardised operations. Checklists and all kind of forms should include all the needed information before they are passed on. Information coming from the office to a shop floor has to stick to a specific standard so that workers do not have to spend extra time on understanding their tasks. Standardized work eliminates the risk of difference in outcomes when different people do the same task with their own approaches (Locher, 2011).

The management of a company that is willing to utilise Lean in its office should pay attention to the following pitfalls (Hajek, 2009):

- *Most office work is people oriented.*  
It results in a higher degree of variability and each process has more decision points compared to a shop floor work.
- *People in offices do multiple jobs.*  
It is more difficult to determine takt time and steps in processes in office than on shop floor.
- *It more difficult and sometimes impossible to work ahead.*  
An order should firstly arrive and only after it can be processed.
- *Changes in a Lean office are less immediate.*  
Many process improvements and changes take longer time in contrast to shop floor.
- *Administrative processes are interconnected with processes from other work areas.*  
It is necessary to know what can be effected due to changes made.
- *Flow tends to be less apparent.*  
Information is a result of work in office, in other words it is a product. VSM and flowchart s are very important in Lean office as it is not possible to a product really moving.

- *In Lean office inputs are more variable.*
- *Handoffs are more complicated.*

When assembler gives a partly finished product to another assembler, they know what to do next. When work goes from one department to a next one in office, often processes and policies are not aligned and it creates extra waste.

Transformation to a Lean office is a big challenge and some results can be seen only in a long-term perspective. However, benefits and gains of a successful Lean office programme can greatly change the working experience and improve performance. The involvement of every office employee in forming the changes and a strong leadership clearly defining a new direction are the keys to success in Lean office implementation. As Lean is not only a tool, but a way of thinking, it will change people's behaviour, attitude to work and the whole corporate culture. It will improve cooperation and communication between employees, make them see that for the same time now they are accomplishing more tasks and thus help their company to be ahead of competitors (Hajek, 2009).

Lean office improvements can be done in such key performance areas and lead to the following effects (Watson, 2010):

IMPROVEMENT AREA	EFFECT
customer orders	increase speed of delivery;
travel requests	reduced travel costs
verify consignment material	improved inventory accuracy
support centres	better customer satisfaction
vacation approvals	improved personnel planning

#### **4.6 An Example of Implementing a Lean Office**

The Antioch Company was founded in 1926 and its headquartered are in Yellow Springs, Ohio It is an company owned by employees having 3 business divisions: Creative Memories (a leader in albums and suppliers for memory preservation); Antioch Publishing (producer and distributor of journals, bookmarks, and other products) and Our Own Image (provider of celebration products to the African and American).

Antioch's revenues in average count for almost \$400 million and it has more than 1,100 employee-owners at 4 manufacturing facilities. Focus of the continuous improvement efforts was mainly on the Creative Memories business, which is the largest division of the company (Huls, 2005).

The Antioch Company conducted a Lean office event immediately after Lean principles were applied to the shop floor. According to the calculations, the company started saving \$32,000 yearly due to Lean office event. This was a good result, but company attributed more value to another outcome, that could not be as easily quantified. That was the benefits of improved communication and the greater awareness between team members who took part in the event. After the event, participants got to know one another better and understood how their work affected others in the same process. In addition to the specific process changes produced by the Lean event, Antioch deeply appreciated the improved team atmosphere and hence better communication and claimed that it resulted in decreased amount of rework, in higher-quality products and faster turnaround time.

Sharing the results of Lean events is incredibly important. It spurs even more Lean activities with initiatives coming from staff. For example, one of the participants of a Lean event at Antioch from sales department applied a continuous improvement concept to her job. She proposed to update mailing lists of the company and this effort saved \$40,000 annually.

Lean office events can reveal activities and processes about which employees did not even know. Every company looks for methods to measure the benefits of any improvement activity, including Lean office events and Antioch is not an exception. However, the management of the company paid tribute to the undergone events and was pleased with the resulting continuous improvement culture. As a result, Antioch does not want to stop with the improvements it has already made but wishes to keep improving. Its next plan was to develop a programme to address waste on their computer network (Huls, 2005).

#### **4.7 Sustaining Lean Momentum**

Once organisation has gone through a successful Lean implementation programme, it is necessary to keep improvements going. Continuous improvement is one of the pillars of

The Lean Thinking House. To be Lean and yield its benefits improvement, momentum must be sustained. To do so, management should schedule Lean events regularly and share the results with the whole organisation. This can be done through posting results on the company internal web and spreading it via available information channels. Thus, employees can understand why Lean events are taking place in their company and what effect they are having. It is also good to recognise Lean teams. Training sessions and Lean events have to happen on a regular basis and be introduced to new employees (Huls, 2005).



## **II. ANALYSIS**

The theoretical part dealt with the general principles of Lean and its advantages especially to an Office. This part deals with an analysis of the way how theory could be applied in practice. A major Ukrainian company which has already been experimenting with new efficient production methods in its plants and has expressed interest in converting to Lean was chosen to proceed with the practical part. In the short time available for preparing the master's thesis it is impossible to do all the practical work related to Lean, but communication at length with the company has been established and in this part a programme for conversion was devised.

The programme for implementing a Lean process is proposed in this work:

1. To do an analysis (profile) of the company.
2. To prepare a strategic plan for the conversion.
3. To plan a Lean training.
4. To show how Lean tools can be applied in the company and how they can improve the performance

## **5 PROFILE OF METINVEST HOLDING, LLC**

Metinvest Holding, LLC is an international company which operates in Ukraine, Europe and the United States in the sphere of steel and coal mining. The company has vertically integrated business with each link of the production chain – iron ore, coal and coke managed through to semi-finished and finished steel production. Company has a wide product range including pipe rolling, shapes and bares, manufacturing of plate and coil and other.

### **5.1 Company History**

Since 2006 when Metinvest Holding was established, it has provided strategic management for the mining and steel businesses of System Capital Management (SCM). A \$400 million syndicated loan from BNP Paribas S. A. brought to Metinvest Deal of the Year Awards and the Awards for Excellence in the Trade Finance Magazine. The next step was an acquisition of leading Ukrainian wholesale and retail metal trading company Lemon Ukraine LLC and a 27% stake in JSC Yenakieve Iron and Steel Works. Metinvest Holding also expanded its business activities and market share by merging with top companies from iron, coal and other related industries over the last six years. According to the Deloitte Top-500 rating, the company was on the 9th place among the largest 500 companies of the Central and Eastern Europe (CEE) by revenue in 2009. The same year the company became the sixth largest manufacturer of iron ore materials in the world. Since that time Metinvest Holding has been taking first positions in Top-100 Ukrainian Business Leaders.

Nowadays Metinvest is the largest steel corporation in Ukraine as well as one of the largest Commonwealth Independent States (CIS) steel and iron materials producer. This places Metinvest among the 24<sup>th</sup> biggest global steel producers according to the World Steel Association. Moreover, the company is among the top-ten world manufacturers of carbon steel plates (Annual Report, 2012).

## 5.2 Current Situation

Metinvest Holding offers a diversified product portfolio which includes iron ore products, semi-finished and finished steel products, coke and coal products as well as rolled products and pipes. The major part of company's steel products is exported to over 1000 customers from more than 75 countries (Fig. 5). The competitive prices of the company's products make its international trade a successful activity.



**Figure 5:** Existing and Potential Markets of Metinvest Holding, LLC (Annual Report, 2012)

One of the competitive advantages of Metinvest is the location of its production facilities in Ukraine that helps to maintain a relatively low cost policy compared to its global competitors. Due to its access to both marine and low-cost rail transportation, the company can inexpensively ship products to the domestic, European and global market including the fast-developing markets of the Middle East, South East Asia, China and CIS (Annual Report, 2012).

## 5.3 Corporate Strategy

Metinvest began taking steps to develop and introduce a new business model that would correspond to their long-term strategy and meet the challenges of changes in world

sophisticated demand. The company's purpose is to establish and to achieve clear quantitative and qualitative targets for 2020 required by the new trends in the global steel market. Metinvest, thus, designed a strategy to transform it from solely a mining and steel seller into a vertically integrated company supplying raw materials to produce high value-added goods and materials and fully realize and use its existing and potential opportunities.

Another goal is to achieve the highest business performance across the SCM with a help of strong management team. One of the ways that company is studying in order to reach those goals is Lean production utilisation. The Lean production approach is designed to streamline processes, reduce cost, hence effectiveness and quality and fully satisfy the requirements of final customer. Metinvest aims to eliminate all defined time and money expenditures that make production process inefficient and creates more value for the customers. For this purpose Metinvest management is seeking for improvements in every aspect of the work that would make products and services for the company better. In 2012 the company started the Continuous Improvement programme with required infrastructure installing and developing a harmonised methodology for the processes (Our Strategy, 2012).

### **5.3.1 Vision**

Metinvest's vision is to become the leading vertically integrated steel producer in Europe, delivering continuous growth and profitability that is resilient to business cycles and providing returns on investments that are above industry benchmarks (Annual Report, 2012).

### **5.3.2 Objectives**

Metinvest's aim is to become Europe's leading integrated steelmaker by adopting the vertically integrated business model for 2020, while delivering sustainable growth and profitability to shareholders. To achieve this, company defined three objectives (Annual Report, 2012):

- Maintain competitive advantage in steelmaking.

The main competitive advantages for the company are favourable geographical location between Europe and CIS, low-cost production base, high level of resource self-sufficiency, global sales network and strong management team.

- Strengthen positions in strategic markets.

The company is well positioned to supply the regions with the largest demand for steel in the world. To diminish the risk of the uncertain global environment, it diversified revenues by cultivating a broad and well established client base. The long-term goal is to enlarge the sales of finished steel goods to 95%, which accounts for almost 80% of the company's product range in 2011. Metinvest is intending to increase its sales of steel in Ukraine and regional markets, where there is clear growing demand for finished steel products

- Achieve world-class business excellence.

The company considers its management team as a core strength because it consists of highly experienced, leaders with international education and excellent track records in steel, finance, consulting and other industries. Recently, the management of the company has launched an initiative to adopt Lean approach for production processes in order to achieve higher value-added for its stakeholders through the elimination of wastes (Our Strategy, 2012).

### 5.3.3 Values

Values support the long-term vision and interest of all company's stakeholders. In addition, the term 'values' explains the main purpose of company's existence and activities (Our Values, 2012):

- *Professionalism*: the company strives to fulfil its responsibilities to the highest possible standards.
- *Client focus*: the customer service is considered to be one of the core principles of business.
- *Life, health and environment*: the company seeks to improve its wellbeing, its working conditions and the surroundings.

- *Leadership*: the company encourages leadership among employees to develop and maintain a talent pool.
- *Teamwork*: - an emphasis on a working culture of close cooperation and mutual concern for safety among all personnel.

#### **5.4 Metinvest's Business Model (MBM)**

MBM describes the way the company uses its strengths to create and deliver long-term value for the stakeholders.

The core concept of the model is based on quality, safety and transparency. Quality of the products, business processes and services are main values for Metinvest. Safety is one of the fundamentals, that is why since its establishment Metinvest has been invested in safety improvements and reducing incidents. The company puts an emphasis on transparency and responsibility of work of every employee. The company applies transparency as an approach to all of its business activities as running company openly increases efficiency of performance and helps to maintain confidence and loyalty of investors and stakeholders. Metinvest tries to maintain: strong management, financial stability, sustainability of resources, experience and expertise, effective risk management and profitable products and services (MetModel).

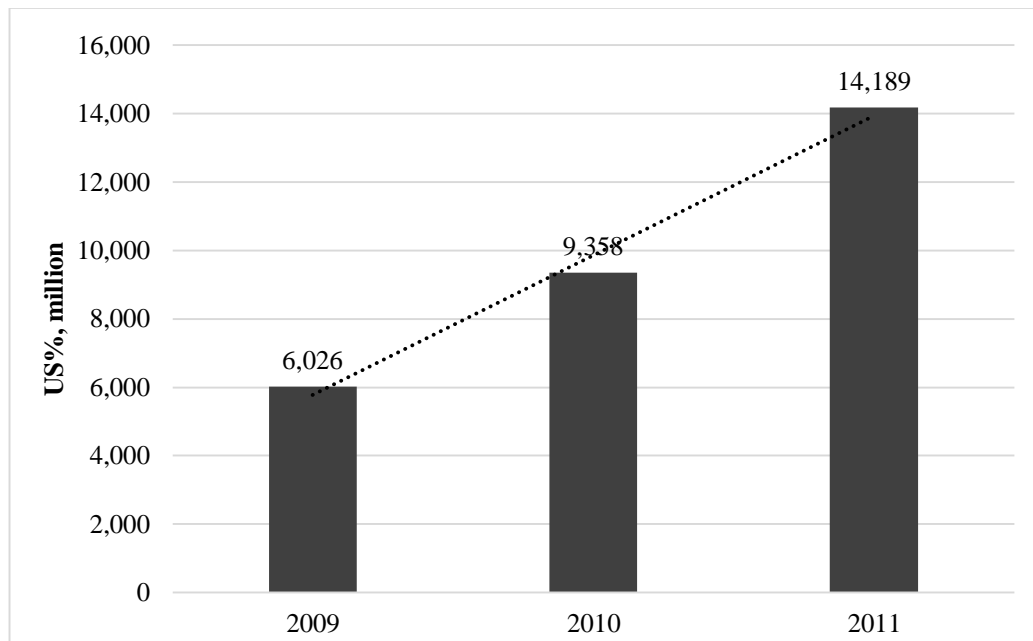
#### **5.5 Key Performance Indicators**

Metinvest has always returned strong operational and financial results. Despite significant macroeconomic volatility, the company is continually improving its financial track record and always shows positive results. Due to greater sales of steel materials and increases in sales prices, revenues, EBITDA and net profit raised, the operational profit was above the average in the industry.

Metinvest continues to generate considerable cash flow and increasing its balance approximately by 80%. Moreover, the company financed a record sum of debt, issued Eurobonds on favourable terms and secured several funding its facilities. These actions helped to confirm its financial confidence (Annual Report, 2012).

## Sales and Revenues

In 2011, consolidated revenues were increased by 51.6 % compared to the result in 2010 (\$ 9.358) and accounted for \$14.189 million. The external revenues of the steel segment amounted to 72.7%, iron ore for 19.8% and coke and coal – 7.5% compared with 61% , 26.7% and 12.3% relatively in the previous year.



**Figure 6:** Consolidated Revenues in 2009-2011 (Annual Report, 2012)

A major contribution to the growth was made by the steel segment, which amounted to 95.4%. It was triggered by 68.7% increase in sales volume along with the rise in average sales accounting for 26.7%. The most demanded products were plates and coils with an increase of sales by 127.9%, pipes (by 119.4%) and long products (by 17.7%). The reason why sales increased so dramatically was the fact that Metinvest integrated with Iluich Steel, boosted capacity at Makiivka Steel and a new product launch at Yenakieve Steel. The rise in average iron ore prices was offset by a decrease in external sales volumes. This is why iron ore sales were accounted for only 6.4% of the consolidated revenues.

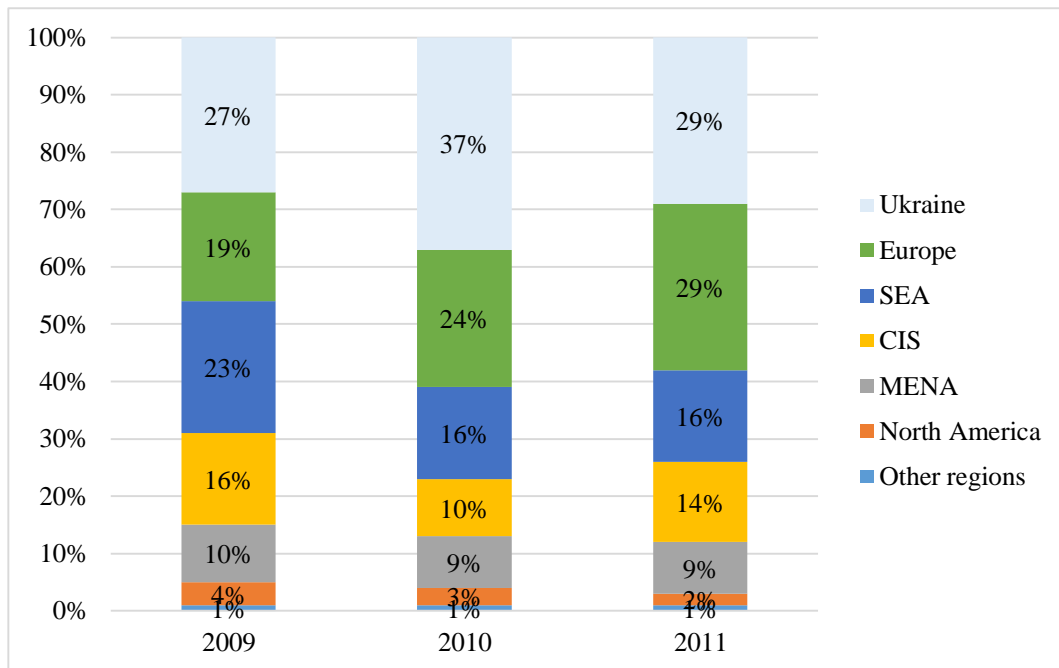
Metinvest International has 16 main offices around the world dealing with customers and providing them the best quality of service regardless the country of client's residence. It sells its products around the globe through the following sales channels:

- Metinvest Eurasia – regional sales network that manages retail and wholesale sales in Russian Federation.



- Metinvest-Ukraine – sales of steel supplies to Ukrainian and CIS industrial customers (except Russian Federation).
- Metinvest-SMC – regional retails steel sales through the network of 13 steel service metal centres in Ukraine which

Sales of Metinvest in Ukraine dropped in 2011 compared to the previous year and on contrary increased in Europe and Southeast Asia (Fig.7).



**Figure 7:** Sales Breakdown by Region in 2009-2011 (Corporate Presentation, 2012)

(SEA – South East Asia, MENA – Middle East and Northern Africa)

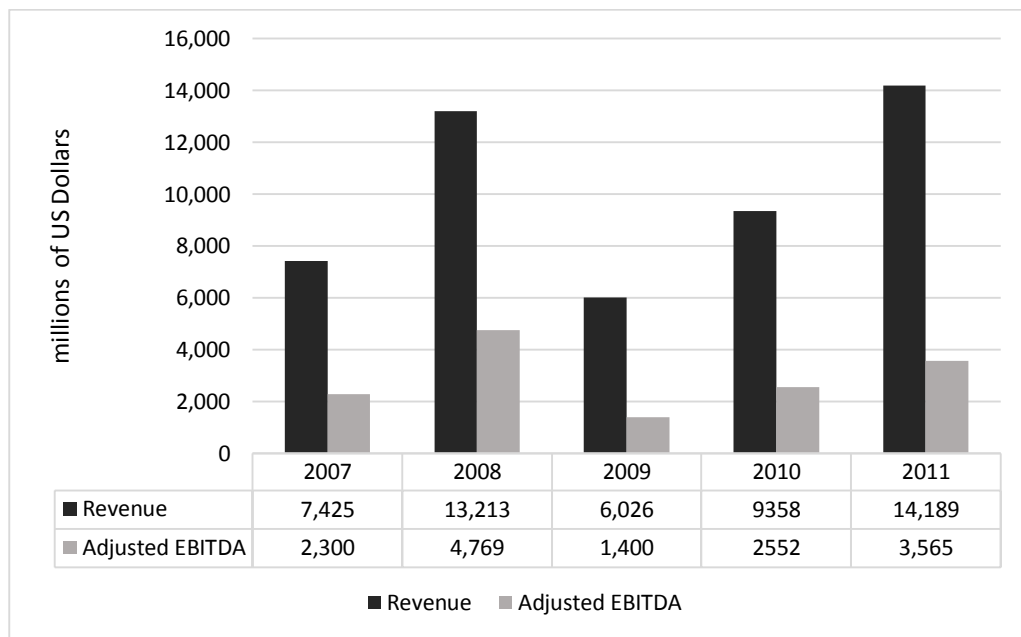
The decrease in domestic sales volumes from 37% in 2010 to 29% in 2011 was due to greater levels of internal consumption at Ilyich Steel.

Metinvest's competitive advantages make it a leader on Ukrainian and international markets. To meet the changing expectations and demands of the customers Metinvest constantly works on developing its products mix and client service, strengthening the focus on the customer and improving all the aspects of its business (Unified Service Sales, 2012).

**Earnings before Interest, Taxes, Depreciation and Amortization (EBITDA)**

EBITDA represents net income plus interest, taxes, depreciation, and amortization added back to it. It eliminates effects of accounting and financing decisions made in different countries and can be used to analyse profitability of companies and industries (Kimmel et al., 2011).

The total amount of consolidated adjusted EBITDA in 2011 amounted to US\$3.565 million which was 39.7% higher than US\$2.552 million in 2010 (Fig. 8)



**Figure 8:** Revenue and Adjusted EBITDA in 2007-2011 (Metinvest AR, 2012)

Due to the worsening conditions on the global steel market, steel products margins were squeezed. This led to a slight decline of the EBITDA margin to 25.1%, from 27.3% in 2010. The Iron Ore segment accounted for 92.4% of Metinvest’s adjusted EBITDA, Coke and Coal for 14.2%, and Steel for -3.6% (Annual Report, 2012).

**5.6 Risk Management at Metinvest Holding, LLC**

Business at Metinvest, as for any other company, faces different risks and has to cope with them on daily, medium-term and long-term basis. The lessening of potential threats is a fundamental part of the Group’s long-term strategy. In order to ensure that ‘Technological Strategy to 2020’ and all related projects are completed successfully at the prescribed time and on budget, risk management must play a central role.

Metinvest's Internal Control and Risk Management system corresponds to leading international guidelines including those developed by the Committee of Sponsoring Organisations of the Treadway Commission the 'Enterprise Risk Management'. The Internal Control and Risk Management department reports to the CFO all aspects of risk management at Metinvest by monitoring operations and defining external and internal strategic, operational and financial risks.

The potential risks that company oversees are as follows:

I. Market risks:

- *cyclicalities of demand and selling price volatility* (fluctuations in demand and prices of Metinvest are driven by cycles in steel and mining industries. In addition, such industries as construction that are the main consumers of steel are also cyclical);
- *fluctuations in the prices of raw materials, energy and services* (there is a shortage in global supplies of raw materials; the cost of energy and gas gradually grows);
- *operating in a highly competitive marketplace* (there are other international steel companies with greater capital resources and more efficient production facilities that makes global steel industry highly competitive. Metinvest also faces competition in the CIS and other emerging markets with low production costs).

II. Financial risks:

- *interest-rate fluctuations* (there are two types of interest rates that Metinvest pays on its borrowings: fixed and variable. Both can be affected: variable ones through links to a benchmark rate; fixed ones at the time of financing);
- *foreign-exchange fluctuations* (since Metinvest is involved in international trade it often makes or receives payments in foreign currency that causes exchange-rate risks. Exchange-rate risk is also can be exposed when assets and liabilities are translated for financial reports into other currencies);
- *counterparty risk or clients, financial institutions* (Metinvest business is not isolated so it can be easily affected by systemic banking crisis or bankruptcy of a client or banking partner for example);
- *limited debt capacities of the steel market and liquidity risk* (one of the Metinvest challenges is to gain adequate liquidity from the operating activities in order to meet its needs of business and financial obligations. Furthermore, problems may

appear because of worsen debt market conditions which influencing company's existing debt obligations);

### III. Operational risks

- *efficiency of capital projects implementation* (substantial capital investment programme may face delays and additional expenses because of lack of capacity or qualified contractors);
- *post M&A integration* (Metinvest has enlarged its production facilities mainly through acquiring production and trading assets. Company has intention to continue its M&A strategy and take more opportunities in the future, however there is a risk of fail in planned integration processes related to timeframes and budget limits);
- *health, safety and the environment* (Metinvest realises the danger that they could pose because of its heavy metal production and other hazardous materials to health and safety of their employees as well as environment and people in surrounding areas. In addition, liabilities for damages to people, property and environment could occur due to accidents);
- *logistical risks* (Metinvest is strongly dependent on availability of railway transport, vessels, access to ports, etc. because of company's broad international and domestic trades);

### IV. Political risks

- *political risk factors in countries where assets are based and in key sales markets* (Metinvest operates in Ukraine, CIS, North America, Europe, North Africa, the Middle East and Asia. Therefore, the differences and changes political climates, legislation governing, property rights and overall business environment may highly affect the trades activities of the company).

When risks are identified the next step is their evaluation, mitigation and further monitoring. Risk Management department has worked out a system of minimizing and eliminating the impact of threat and risks on their business. Executive Committee and Board of Directors also control risk management on a regular basis (Annual Report, 2012).

## 5.7 Corporate Social Responsibility

Being a party which signed an agreement of the United Nations Global Compact, Metinvest guaranteed to align its business and operation with ten universally accepted global principles including human rights, labour, anti-corruption and environment protection.

In March 2012 Metinvest was recognized as a number one among companies in Ukraine for its Corporate Social Responsibility (CSR) application reflected in significant contributions to local communities (around US \$10 million), transparency and reliability in the area. Metinvest involved more than 1500 members of local communities to take part in different CSR projects.

The main areas of CSR focus of Metinvest are provided below:

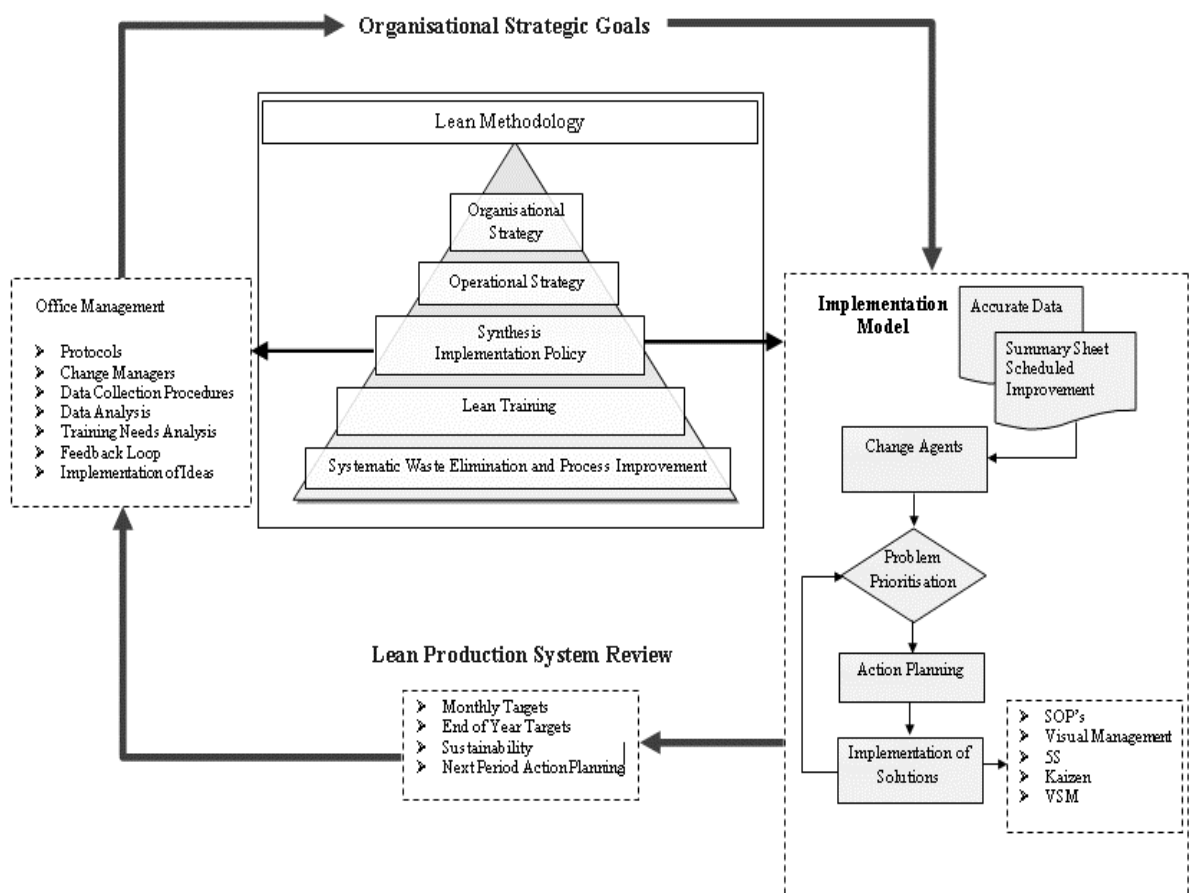
- health and safety;
- protection of the environment;
- employees development and social support;
- improvement of the efficiency and quality of social investments ( development of local communities).

In 2012, Metinvest introduced a new 5-year strategy for social support and development. Its main purpose is to involve local communities to participate in every stage of priorities unification and reinforce their efficiency across the entire Holding. Those priorities are education, healthcare and infrastructure in the communities where the company operates (Responsibility, 2012)

## 6 A STRATEGIC MODEL FOR INTRODUCING A LEAN OFFICE

### 6.1 Model Overview

The model as outlined below is a suggested model for introducing a Lean Office process (Fig.9). This model incorporates all of the key strategies needed to create the skills, knowledge and application capability within Metinvest to start establishing an in-house capability to sustain Lean in the future.



**Figure 9:** Model for Introducing a Lean Office process (own source)

It will also form the basis of the reporting system with responsibilities to ensure the programme is being delivered on time and to the agreed targets.

It clearly outlines where areas of responsibility lie for certain actions within the plan, from operational implementation to management support and direction.

## **6.2 Components of the Model**

These form the basis of understanding what the overall strategy looks like by creating a picture or a diagram of the key elements, how the key elements will be achieved through implementation and reviewing the effectiveness of the strategy and the implementation through management and senior management reviews. There are 3 key components to the model (Fig.9): the Methodology, the Implementation model and the Lean Production System review process.

### **6.2.1 Methodology**

The triangular Methodology clearly shows the key elements required to make the whole programme a success. The underpinning of the whole programme through the implementation of waste elimination and process improvement is fundamental upon the programmes objectives of making Metinvest Lean. Without these fundamentals in place then the programme will never succeed.

To do this as many members of staff as possible need to understand the concept of continuous improvement and waste elimination as possible and this will be facilitated by the next level of the methodology, Lean Training.

### **6.2.2 Implementation Model**

Success in implementing Lean is more about changing the way people think than physical or technological changes. A programme of Lean training is suggested in the next section to support this requirement.

The Synthesis Implementation Policy is the tactical plan required in the office to achieve the higher organizational aims. This policy is determined by each of office areas having their own;

- Data collection and analysis system
- Integrated targets linked to the overall company objectives
- Scheduled improvement programme derived from the targets

- Training plan for staff linked to the requirements of the implementation programme

Most of this will be completely new to the office. The chances are that there is no data collection or analysis system in place. Targets may exist but are vague. This is why the Implementation policy should be jointly owned by the manager of that area and the Change Agent responsible for that area. (This change agent is an important person in the process and must be selected carefully) Together they will deliver the ideas and improvements identified and prepare reports on a monthly basis for the Lean Production System Review process and assess progress against the various Lean objectives.

The implementation is the area where the opportunity to involve staff lies, to get everyone thinking 'Lean' it is imperative to involve shop floor staff in identifying and making improvements in a controlled way, thereby creating a 'Culture' of Lean throughout the office.

### **6.2.3 Lean Production System Review**

The third element of the Strategic Model is the Lean System Review. This is probably the most important part of the whole strategy, because without reviewing performance against the plan then no improvement can be measured. Performance measure have to be in place before the process commences.

The reviews are planned on a monthly basis to review actual outcomes against planned activities. The reviews should be held at each level of the organisation. At the administrator level to analyse productivity data, at departmental level to assess general impact and at senior manager level to ensure adherence to strategy.

There should also be an annual review whereby the previous year's performance will be analysed against the strategy and plan. The outcomes from this session will be married up to the objectives of the organisation for the coming year and the new annual plan developed from this review process.



## 7 A SUGGESTED PROGRAMME OF LEAN TRAINING

Training is a major feature of Lean Implementation as it has been mentioned in the previous chapter. It is aimed at all workers and never ends.

This is based on work already done on a major refrigerator producer, NORD, in Ukraine. There is a level of detail here which was too much to be explained in the theoretical part but is inserted to demonstrate the full power of Lean. Five major areas for training are suggested for the Metinvest Offices.

### 7.1 Training 1: Visual Management

Visual Management Systems involves the display of information to enable simple and effective control of the workplace. Good Visual Management requires no interpretation and provokes a reaction. It is said that information is a power when it is shared. The most effective way to share the information is to make it visible for all employees. It is very important as shared information brings awareness of performance to all levels of the process.

Visual Management is applied to control the process which consists of 3 main stages:

- Inputs            Labour, Material, Overheads
- Methods        Converting Inputs to outputs
- Outputs        Quality Cost & Delivery

The control is done through managing and communicating the performance.

Visual Management extends far beyond display boards:

- a method of workplace control requiring minimum complexity, instruction or training;
- an integral part of 5S activities;
- used to manage the working environment;
- visible scheduling (Kanban);
- walkways;
- floor footprints;
- colour coding.

Visual Management also shares a real-time information about the status of the department:

- What are the goals?
- What are the key measures?
- How is the department performing in relation to those goals?
- What is preventing the department from reaching our goals?

Most importantly, how does each worker's individual effort contribute toward the success? Visual management provides a clear and common understanding of goals, measures and standards.

## 7.2 Training 2: Standardised Operations

A standard operation is the *current* best method available to perform a *specific* task, enabling the objectives of good *safety* performance, high *quality*, minimum *cost*, and *on time delivery* to be achieved, *consistently*.

- It can be used in the training of staff.
- It uses the best current method as the standard.
- It reduces variations in the process.
- It is a tool to help manage the workplace (skill control).
- It is an audit document.

The Standard Operation is considered to be the corner stone of all continuous improvement activities performed within any company.

The process will always be to the same specification, enabling control of: Costs, Time, Quality, and Safety. Therefore, the workplace will become more effective.

Standard Operations guarantee that the process conforms to the required quality standards:

- Uses the minimum of effort, facilities, time and materials.
- Keeps the workplace clean and tidy.
- Improved safety.

- Easy to follow by any employee (given training).
- Best method currently available.

The Standard Operation Sheet (SOS) should be used as a means of recording all standard operating criteria. It presents the information in a structured, chronological format and contains the information required to perform a task. SOS highlights key points i.e. costs, time safety, and quality. It should be a true 'live' document representing everything connected to the operation and constantly monitored and adjusted.

To write a Standard Operation it is necessary to analyse thoroughly the operation, find or develop the best method, highlight all main steps, identify the above mentioned key points and include all additional information that can anyhow influence the operation or help to understand it.

The Standard Operation is the best current method of performing the operation among all the possible options, however things can change:

- The Standard Operation needs to be reviewed regularly.
- Any suggested changes should have trials.
- Proven improvements should be adopted.
- Sheets should be revised and approved.
- Changes to the Standard Operation may require retraining for the staff and amendments to the skill matrix.

Deviation from Standard Operation brings about a disproportionate increase in abnormality control.

### **7.3 Training 3: Kaizen**

Kaizen or continuous incremental improvement requires to study each step of the analysed process to make continuous incremental improvements to the safety, efficiency and quality of the workplace and the individuals within it. Everyone must share this same mind-set and not be afraid of changes. It is easier to get 100 people to make 1 change than to get 1 person to make 100 changes. Personnel has to understand what is needed for a continuous improvement culture and find the ways to sustain it. During the workshop participants have to think whether Kaizen is already used in some form in the

company or it is totally new and in this case start looking for ways of implementing it. Lean trainer cannot come with great improvement ideas at once while he or she is not aware of all details and specifics of the process, but the trainer has to try to guide employees through the procedure of finding and undertaking possible improvement activities.

#### **7.4 Training 4: Waste Elimination**

Elimination of the seven wastes applied to Metinvest:

Over production. In the Lean office, over production means that work is repeated several times. Several forms are filled in, many stamps and signatures are gathered whereas in fact, one form and one signature may be sufficient

Defects. Forms are badly designed so that it is easy to pick up the wrong information or important information is not immediately apparent.

Inventory. Inventory will often mean staff i.e. too many staff doing the same process. The system must be designed so that it is Lean.

Excess processing. The office system produces forms and materials that are not needed and are often just repeats of other forms.

Transport. How forms are moved around. If they are between staff, are these staff in the same building. If not then why. If it is unavoidable then what is the most efficient way of transporting it.

Waiting. How much time is wasted waiting for signatures or forms. If it takes too long, the procedures must be redesigned.

Maintenance. Whether office machines such as personal computers, photocopiers, printers regularly maintained. Are there often queues? Understanding how to reduce all the queues.

Overall, the team has to reduce the process variability which can only be achieved by the application of Standardised tasks described in the previous workshop. The aim is to eliminate non value added activities via identifying which processes are not needed and therefore are non-value added.

## 7.5 Training 5: Problem Solving

5 Whys techniques should be explained well, and participants of the training have to start solving some very simple problems applying this techniques. When they understand how it works, more complicated cases can be challenged. A very simple example of utilizing 5 Whys in an office is provided below:

Why was the travel document not issued on time?

- *Form not submitted in time*

Why was the form not submitted in time?

- *Did not have the required signature*

Why did it not have the required signature?

- *Person who signs could not be found*

Why could the person not be found?

- *She was ill with no nominated replacement*

Why is there no replacement?

- *No system in place*

Asking 5 times why allows to dig deep into the problem and find the root of it. Sometimes it might be needed to dig even deeper. When solving problems it is very important to understand it fully and solve completely in order to prevent it appearing again in the future.

## **8 APPLICATION OF LEAN TOOLS IN THE OFFICE ENVIRONMENT OF METINVEST HOLDING, LLC**

Metinvest has many offices which are located in different countries all over the world. Each of the offices perform a great amount of processes every day and does its best to deliver products and services of the highest quality to the customers. The company permanently seeks for the best methods of improving the production processes and one of such methods that is being already used is Lean production. It aims to improve the production process and, as a result, the quality of the products. The same method can be applied to improve processes and quality of the services in the administrative area of Metinvest,. The following section will examine how operations in Metinvest's branch XXX can be improved by the application of value stream mapping and 5S System. It must be stressed that because of the time and geographical restrictions, this work has not yet been done but the section will outline the steps that will have to be taken if Metinvest decides to go the whole way.

### **8.1 Role of Management in the Process of Implementation of Lean Tools**

The management of Metinvest must play a role of an initiator of implementation of the continuous improvements needed for the transformation to Lean. Another task is the execution of the changes leading to become Lean. Leaders of XXX have to be supported by the management to implement changes that may be initially be very unpopular. Top-managers need to communicate with other managers and workers and spread the advantages of Lean. It is highly important to explain the reasons of the transformation to Lean and the application of its tools. The management of XXX can do this via:

- monthly meetings with workers to inform them about changes in customer needs and preferences, current situation in order processing, complaints coming from clients, etc.;
- showing examples of best Lean transformation and utilization practices;
- provision of help and support to every employee.

XXX leaders cannot be engaged in every Lean event or activity and control it because of other work obligations, but they must be enabled to appoint someone (a specialist) to conduct those events. In this way, it is easier to acquire information related to the transformation process. Management can support the appointed person and show its interest in Lean through, for example:

- allocation of resources and time for employees trainings, including Lean;
- creation of incentives for a successful work;
- constant contact with Lean teams;

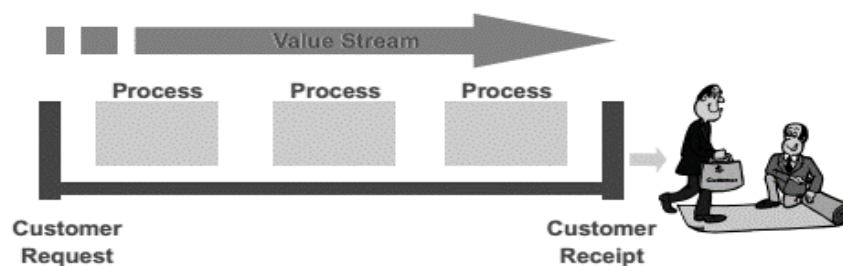
Metinvest claims that its mission is to provide more quality and value than customers expect. According to the results of customers' survey, customer's satisfaction at Metinvests' branch XXX has been decreasing over last 2 years and mainly due to a slow responses to clients in Customer Service department (Annual report, 2012).

This fact attracted attention of the management and director of XXX proposed to use Lean tools to tackle the problem. As far as Metinvest has already been using Lean principles in production, it was decided to apply value stream mapping and 5S System in order to analyse the case and come up with recommendations on further improvements.

The following section outlines the process that Metinvest will have to implement when doing a VSM

## 8.2 Value Stream Mapping

Value stream is a set of activities which are required to fulfil a request from a customer starting from the order and finishing with the delivery. In some cases it may go beyond delivery to the moment when cash is received (Fig. 10).



**Figure 10:** Value Stream (Karen and Osterling, 2012)

VSM is a tool that helps companies to see the process in order to determine what actually takes place and what needs to happen. To draw a VSM it is necessary to form a team and provide a Lean training session to its members. Cases of successful Lean implementation into manufacturing environment are a good beginning of the whole event. They serve as an extra argument while convincing the office managers in cost-effectiveness. The calculation of the cost-effectiveness of a Lean office event is a very complicated task and cannot be done in every case. Selecting team members directly depends on which processes will be assessed by VSM. The main rule for selection is to determine the major processes related to the Lean event and divide them into sub processes. Then, find the owner of each sub process. Fundamental training then follows. Its purpose is to create common language for team members.

Table 4 is an example of a training aimed at introducing Lean production.

**Table 4:** Lean Production Training (own source)

<b>Participants:</b>	<b>Duration (days)</b>
Lean event team members	
<b>Plan</b>	
1. First insights into Lean	1
2. Imitational modelling	2
3. Value Stream Management technique	3
4. Waste recognition and elimination	1
5. Continuous improvements	1
6. Presentation of the results	1
<b>Total</b>	<b>8</b>

Training can be conducted by a team leader, who is a specialist in the topic or outsourced. Nowadays there many professional consulting companies and organisations that provide such kind of training sessions.

To do a VSM, the following steps need to be done. Hypothetical case is taken to illustrate the main points and techniques of VSM.





The matrix shows that C1, C2, C4, C6, C8 go through the same sub processes and all together count for 75% of all customer requests. Thus, the Lean event team concentrated on improving "The orders processing in XXX". The sub processes from Table. 5 are described in the following step.

### 8.2.3 Sub processes and their owners

All the information would be collected by the Lean event team members at the places where actual sub process were happening.

There are 8 sub processes of the chosen process and 6 owners of them:

- 1) Orders sorting in Distribution department – Manager 1.
- 2) Orders sorting in Sales department – Manager 2.
- 3) Orders initiation by service agent 1 (SA1) – Manager 3 or Manager 4.
- 4) Orders information proof by service agent 2 (SA2) – Manager 5 or Manager 6.
- 5) Setting the execution time by SA1 – Manager 3 or Manager 4.
- 6) Orders final check by SA2 – Manager 5 or Manager 6.
- 7) Orders sorting in Sales department – Manager 2.
- 8) Orders sorting in Distribution department – Manager 1.

When the information is collected, there would be a meeting convened to discuss it and draw up the VSM. The information about the number of requests and their details for a specific period (a month), will help to determine the average number of quantities per each request. Typically, the customer service department for one month received 600 requests for 7800 pieces. So the average number of pieces per one request was  $7800/600 = 13$  (lines).

The second type of information to be collected by the team is a description of customers and the 8 sub processes related to the processing of the orders in XXX that are mentioned above.

#### Description of customers and their requirements

Orders are made in 3 ways: by post, by fax and urgent orders by phone. Orders from customers made by post arrive at the Distribution department three times a day at 9 a.m., 1 p.m. and 4 p.m. Orders made by fax arrive directly at the Sales department, while

urgent orders made by phone go directly to SA1 (Manager 3 or Manager 4). Customers get confirmation of their orders by fax from SA1 after he or she gets an approval from SA2. Those customers who send orders by post get a confirmation from the Distribution department. Majority of customers require their orders to be processed within 1 day.

1) Orders sorting in the Distribution department (PT1=15 seconds =0,25 minutes, QT1=480 minutes)

Manager 1 is responsible for sorting all the incoming orders by post. He sorts the orders and puts them on a shelf of each department. It takes him 10 seconds to determine to which department order should be passed and 5 seconds more to put the letter on that shelf. Post from the Distribution department is passed next to the Sales department once a day at 11 a.m., meaning that the queue time (QT1) is 480 minutes, it is duration of the working shift. Process time (PT1) equals 15 s.

Karen and Osterling (2012) define *process time* as the time needed to actually perform the work (sometimes called work time, touch time, cycle time). *Queue time* is a period of time inventory is staged prior to processing. In the current case, inventory means any finished work that is waiting for further processing.

2) Orders sorting in the Sales department (PT2=20 seconds=0,33 minutes, QT2=480 minutes)

Manager 2 is responsible for sorting the orders coming from the Distribution department. He sorts them by the names of the Companies spending approximately 6 seconds, 5 seconds he spends on stamping the letters with orders and puts them to the folders, about 9 seconds. Once a day at 2 p.m. all folders are taken to the SA1.

3) Orders initiation (PT3=40 seconds\*13 lines=8,67 minutes, QT3=240 minutes)

Either Manager 3 or Manager 5 initiates an order by feeding data into computer. This lasts about 40 seconds. Sometimes extra work is required, it takes in average 5 minutes. An urgent order is processed in 10 minutes. The initiated orders are placed into folders and taken to SA2 twice a day. If it is done more than 2 times a day, SA2 does not have enough time for processing them. There are cases of delays in bringing these folders counting in average for 240 minutes.

4) Orders information proof (PT4=107 seconds\*13 lines = 23,18 minutes, QT4=120 minutes)

SA2 receives folders with orders twice a day and checks them in a computer system spending 12 seconds on each line, makes correction spending 15 seconds on each line. 20 seconds per line is spent on setting the necessary number of the requests. He spends 60 seconds on each line to set a price for the order and assess the execution time length. Every 120 minutes folders with orders and taken back to SA1.

5) Setting of the execution date ( $PT5=40 \text{ seconds} \cdot 13 + 90 \text{ seconds} = 10,17 \text{ minutes}$ ,  $QT5=60 \text{ minutes}$ )

SA1 sets a date for completion an order spending 40 seconds on each line of an order. Afterwards, he makes a copy of the order and puts it to the appropriate folder, 90 seconds per one folder; the folder is then taken to SA2.

6) Orders final check ( $PT6=20 \text{ seconds} \cdot 13 \text{ lines} = 4,33 \text{ minutes}$ ,  $QT6=240 \text{ minutes}$ )

SA2 checks all prices and execution dates requiring 20 seconds for the each order's line. Extra time waiting counts for 240 minutes.

7) Orders sorting in the Sales department ( $PT7=40 \text{ seconds} = 0,67 \text{ minutes}$ ,  $QT7=240 \text{ minutes}$ )

Manager 2 sorts the orders spending 40 seconds on each one. Twice a day he takes the sorted orders to the Distribution department. Extra waiting time is 240 minutes.

8) Orders sorting in the Distribution department ( $PT8=40 \text{ seconds} = 0,67 \text{ minutes}$ ,  $QT8=480 \text{ minutes}$ )

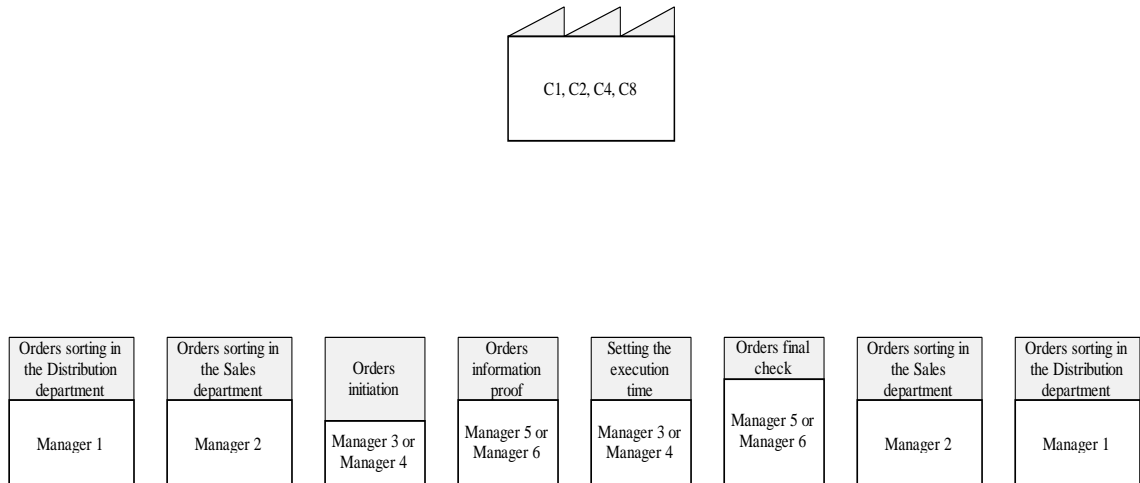
Manager 1 puts stamps on all the orders' copies and sends them to the customers once a day. It takes him 40 seconds and extra waiting time is 480 minutes.

At this point the Lean event time has all necessary data and information to start to draw up the current state VSM of "The orders processing in XXX".

#### **8.2.4 Current state VSM of "The orders processing in XXX"**

The first step to draw up the current state VSM begins by putting a box representing customers in the top of the map. In this case it is just one box, because customers and suppliers are the same companies (C1, C2, C4, and C8). Next process boxes are to be put on the map (both inbound and outbound). There are two boxes for the process of

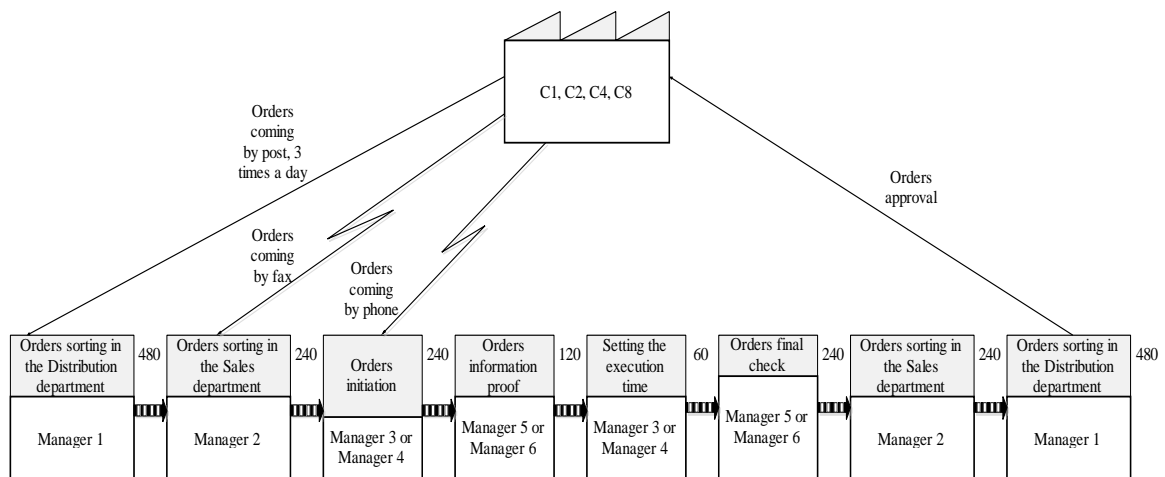
'Orders sorting' in the Distribution department, the left one representing inbound process and the right one representing outbound process, with the process owner Manager 1 (Fig. 11).



**Figure 11:** Sub Processes (own source)

All sub processes of the "The order processing in XXX" are put between the inbound and outbound processes and the first draft of the VSM is shown on Fig.11.

Then, queue times are put between the processes and it is important that it is shown in the same units, minutes for this case, as well as all the communications and flows (Fig.12).

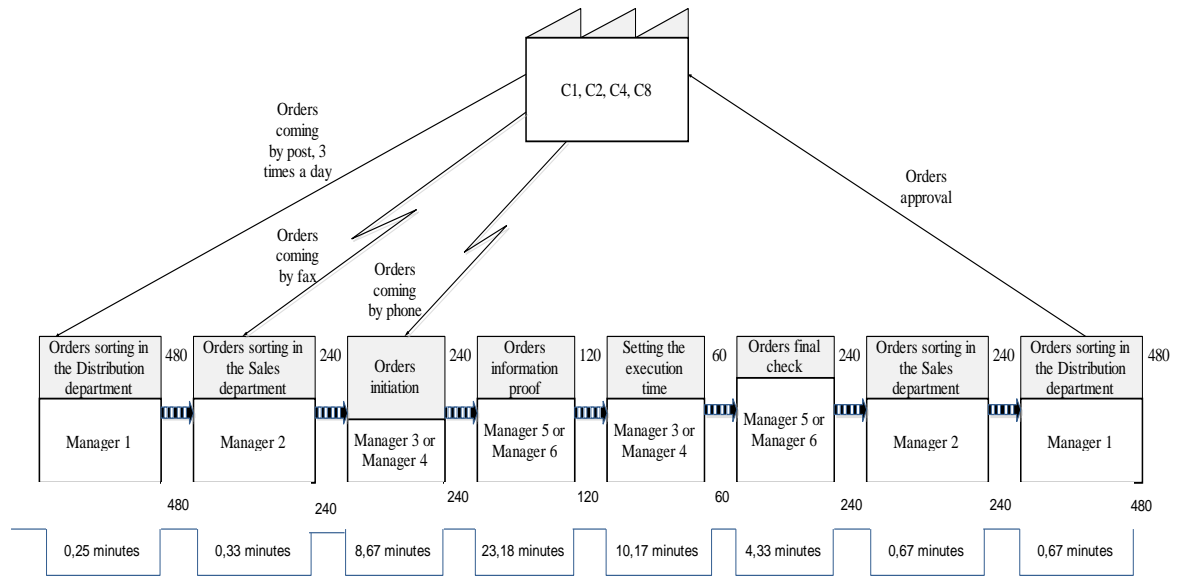


**Figure 12:** Current VSM with Communication Flows (own source)

Main time characteristics have to be determined and added to the VSM (Fig.13). Such characteristics are:

- process time (PT);

- total process time (TPT) – sum of process times of all independent (sub) processes. This time is also called a value-added time;
- queue time (QT);
- total lead time (TLT) – sum of TPT and all QT:
- Defective Parts per Million (DPPM) – number of mistakes made in orders per million.



**Figure 13:** Current VSM with Communication Flows, PT and QT (own source)

Total Process Time for the current value stream (TPT appears) for an average order of 13 pieces equals:

$$\begin{aligned}
 TPT(c) &= TP1 + TP2 + TP3 + TP4 + TP5 + TP6 + TP7 + TP8 = \\
 &= 0,25 + 0,33 + 8,67 + 23,18 + 10,17 + 4,33 + 0,67 + 0,67 \\
 &= 48,27 \text{ minutes}
 \end{aligned}$$

TQT for the whole process of making order in XXX:

$$\begin{aligned}
 TQT(c) &= QT1 + QT2 + QT3 + QT4 + QT5 + QT6 + QT7 + QT8 \\
 &= 480 + 240 + 240 + 120 + 60 + 240 + 480 = 2100 \text{ minures}
 \end{aligned}$$

Management team is interested in the TPT length, but customers care only about orders processing time (TLT), that is how fast a company reacts on customer requests. So this is a true measurement for assessing the quality of customers' service.

$$TLT(c) = 48,27 \text{ minutes} + 2100 = 2148,27 \text{ minures or } 35,8 \text{ hours}$$

For a working day duration of 8 hours, the total order processing time is:

$$TOP(c) = 35,8 \div 8 = 4,47 \text{ working days}$$

Value-added time equals:

$$VAT(c) = 48,27 \text{ minutes} \div 2148,27 \text{ minutes} \times 100\% = 2,24\%$$

Even more important for the customer is a percentage of accomplished orders for a period of less than 24 hours counting from the time an order was made. According to the information collected by the Lean even team, less than 33% of orders are accomplished within 8 hours or 1 working day.

The DPPM also characterises the quality of work done within a department. It shows a concrete amount of lines with mistakes made during order creation. 2 wrongly filled lines mean there are 2 independent mistakes. 35 mistakes were found through the observation made by the team. To calculate DPPM it is necessary to divide the number of mistakes by the number of lines in the orders and multiply by 1000000:

$$DPPM(c) = 35 \text{ mistakes} \div 7800 \text{ lines} \times 1000000 = 4487$$

All the above calculated measurements are presented in Table 6:

**Table 6:** Lean Measurements Representing the Current State (Tapping, 2009)

Lean measurements	Current state
Total process time (TPT), minutes	48,27
Total order processing time (TOP), days	4,47
Percentage of order accomplished in 8 hours	33%
DPPM, pieces per million	4487

The current VSM is now finished and the next step is to come up with ideas on how it can be changed and improved. These requires a Future VSM.

### 8.2.5 Future state VSM of "The order processing in XXX"

XXX has to find out how well it satisfies customers demand which can be characterized by takt time (TT) of incoming and processed orders. Takt time – is the amount of an available production time divided by a customer demand (Karen and Osterling , 2012).

To obtain an everyday customer demand, the team has to agree on its unit of measure. It can be a number of lines in an order while it is related to a takt time. The amount of lines in the orders for a period of 10 weeks is approximately 25 000 lines. As far as XXX works 5 days a week and the working day lasts 480 minutes, the average daily order is:

$$25000 \text{ lines} \div (5 \text{ working days} \times 10 \text{ weeks}) = 500 \text{ lines a day}$$

Time needed to process 1 line of the order is in one working day (or current takt time) is:

$$480 \text{ minutes} \div 500 \text{ lines a day} = 0,96 \text{ minutes}$$

The Lean event team should also analyse customer demand on the all kind of orders being processed, in the case of XXX these would be urgent orders coming by phone and returned orders. There are in average 10 urgent order coming during a day, so the TT for urgent orders is:

$$480 \text{ minutes} \div 12 \text{ urgent orders a day} = 40 \text{ minutes}$$

The average amount of returned orders per day is 12, so the takt time for the returned orders is:

$$480 \text{ minutes} \div 12 = 40 \text{ minutes}$$

An average order is estimated to have 16 order lines, so it takes  $16 \times 0,96 \text{ minutes} = 15,36 \text{ minutes}$  to accomplish one order.

To draw up the future state VSM the Lean event team has to go through the identical steps to those when creating a current state VSM. Evaluation of the performance of the Distribution department and the Sales department should help to find the optimal usage of the employees working time and hence reduce it.

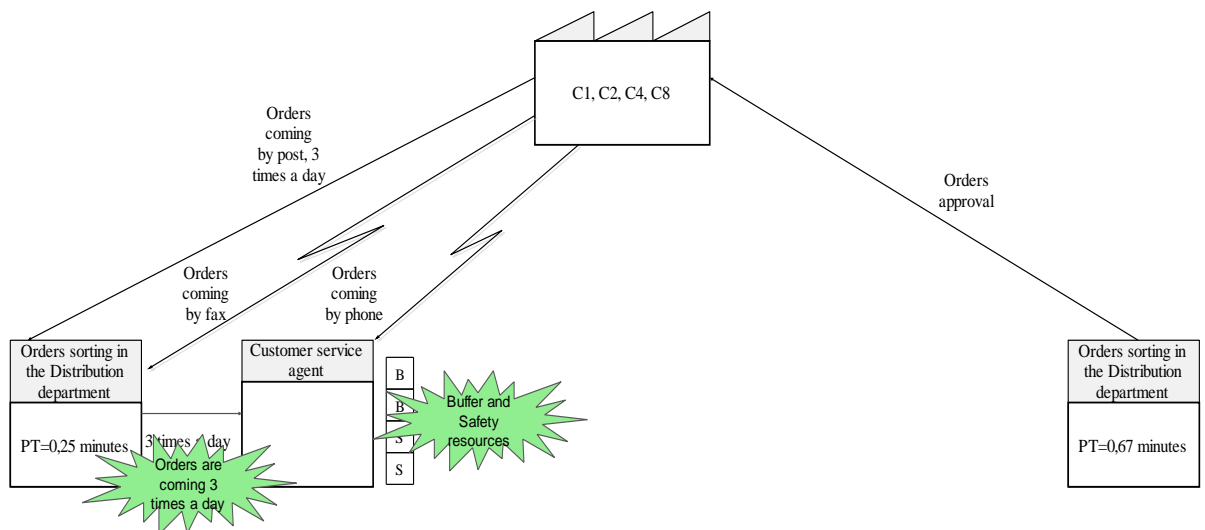
Orders coming by post and fax to the Distribution department can be delivered from to the Sales department 3 times a day, not just once, directly to the customer service agent. This agent can receive orders coming by phone too. It would also be easier for him to



predict possible delays. There are few ways to decrease the delays' length which can be achieved via buffer and safety resources.

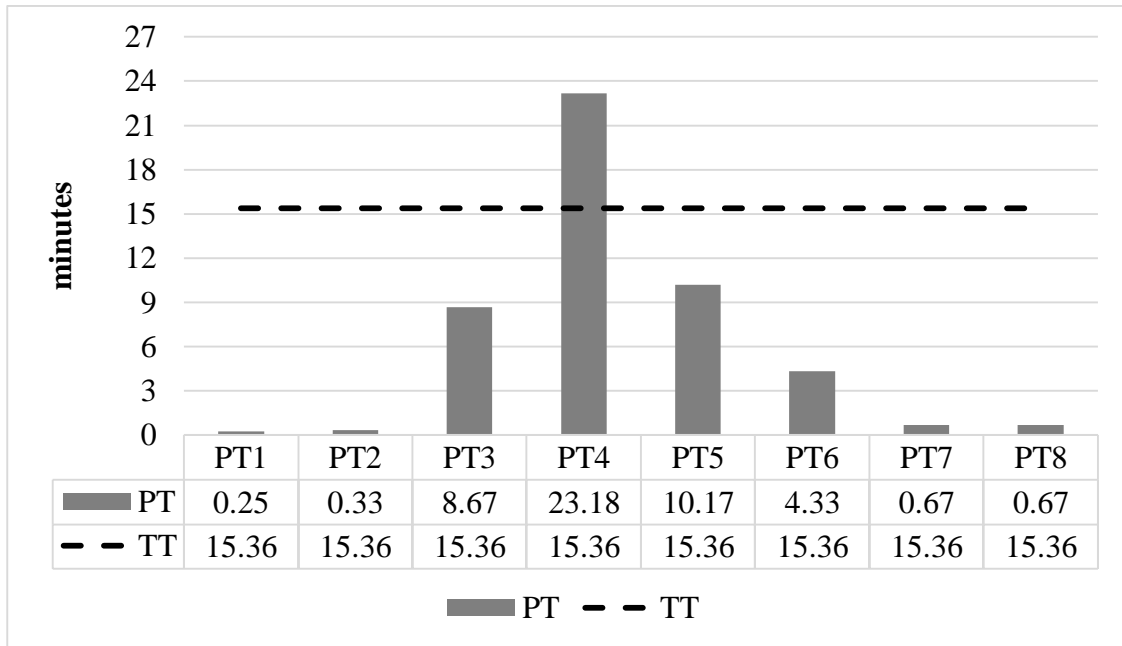
Buffer and safety resources – any form of protection downstream operations from being stuck due to process variance (Rother et al. 1999).

Buffer and safety resources for the current case in XXX can include a team work (in case some manager is not managing to process the request other team members can help), extra working time (if some requests are not finished during the working day, managers should work extra hours), attraction of the head of the department to work with some requests, and employment of additional part-time employees. These 4 resources and the above proposed changes are shown on Fig.14.



**Figure 14:** Future State VSM Drawing (own source)

As it has already been mentioned, delays can happen. It is more difficult to predict delays in the office environment compared to the manufacturing, especially if there are many sub processes and work load is considerably fluctuating at different phases. Lean team can compare time spent at each sub process (Fig.15).



**Figure 15:** Current Distribution of Workload (Tappin, 2009)

Fig.15 shows that workload is not balanced well and it might create extra waiting time in the process, PT4 lasts much longer compared to other sub processes and is above the takt time (TT). To solve this problem Leant event team can calculate a number of managers required to process requests within TT.

$$\begin{aligned}
 \text{Number of managers} &= TPT \div TT = (PT3 + PT4 + PT5 + PT6) \div TT \\
 &= \frac{8,67 + 23,18 + 10,17 + 4,33}{15,36} = 3,01
 \end{aligned}$$

In the formula above it is necessary to include time only of the processes which are directly connected to the request processing in a specific department, that is why PT1, PT2, PT7 and PT8 are not included. So, from the calculations above it can be said that 3 workers are required and processes 3,4,5,6 should be divided by them to avoid extra queuing time and balance the workload.

Hejunka box is another Lean tool that can help to improve the process. It is sometimes called a levelling box and is used for levelling volume and mixing of production through distribution of information or sub processes at fixed intervals (Marchwinski et al 2008).

This tool will help to distribute orders' processing results among the managers. Hejunka box will be filled with orders every 160 minutes or 3 times a day. As a result flow of the process will be more sustainable and reliable.

Merge sub processes such as Order initiation, Orders information proof, Setting of the execution time, Orders final check, Orders sorting that was made in the Sales department and create a new department called Orders Processing

5S System can also be used in the offices engaged to the value stream in XXX. The main purpose of 5S implementation is to eliminate wastes, create better working conditions which could help to improve the performance of orders processing. A hypothetical programme of 5S system implementation is provided in the next part.

Orders from the Orders Processing department should be passed 3 times a day, so that  $QT=480 \text{ minutes} / 3 = 160 \text{ minutes}$  not to create work overload.

After the proposed improvements are made, current VSM of "The orders processing at XXX" transforms into the future VSM (Fig.16).

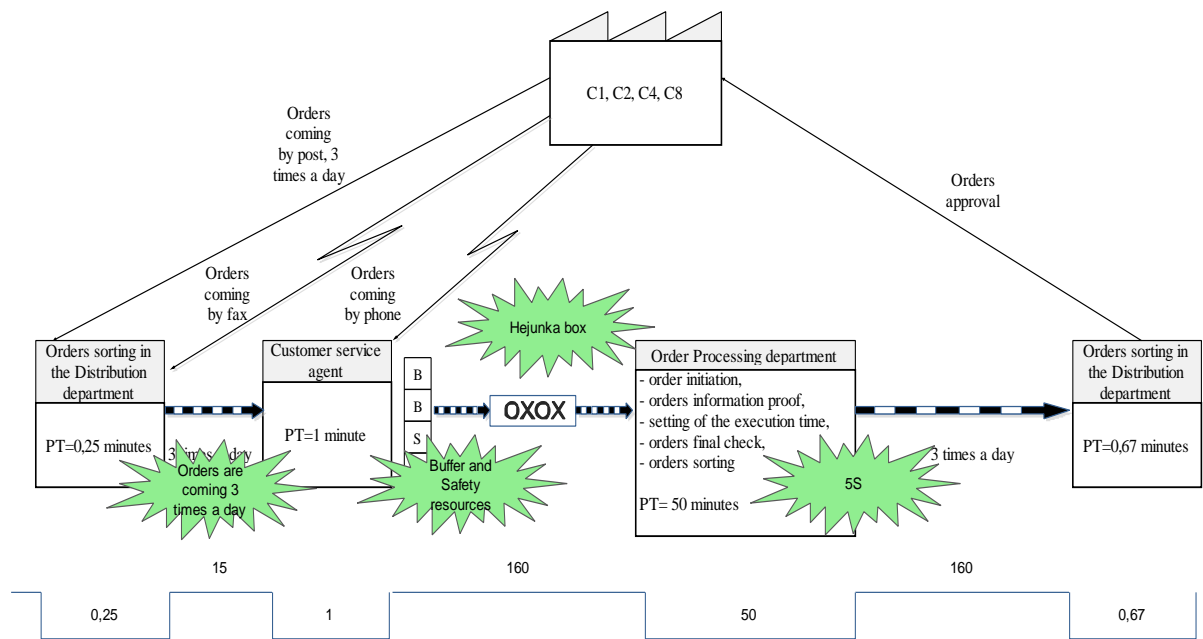


Figure 16: Future State VSM with Proposed Improvements (own source)

Main time characteristics have to be recalculated to show how the proposed changes improved the business performance of XXX.

$$TPT(f) = 0,25 + 1 + 50 + 0,67 = 51,92 \text{ minutes}$$

$$TQT(f) = 15 + 160 + 160 = 355 \text{ minutes}$$

$$TLT(f) = 51,92 + 355 = 406,92 \text{ minutes or } 6,78 \text{ hours}$$

$$TOP(f) = 6,78 \text{ hours} \div 8 \text{ hours} = 0,85 \text{ working days}$$

$$Value - added\ time(f) = 51,92 \text{ minutes} \div 406,92 \text{ minutes} * 100\% = 18\%$$

$$DPPM = 7 \text{ mistake} \div 7800 \times 1000000 = 897$$

Putting these results to the table with the chosen Lean measurements it is possible to compare the performance of the analysed process "The Order Processing in XXX". (Table 7)

**Table 7:** Comparison of Current and Future VSMs (Tapping, 2009)

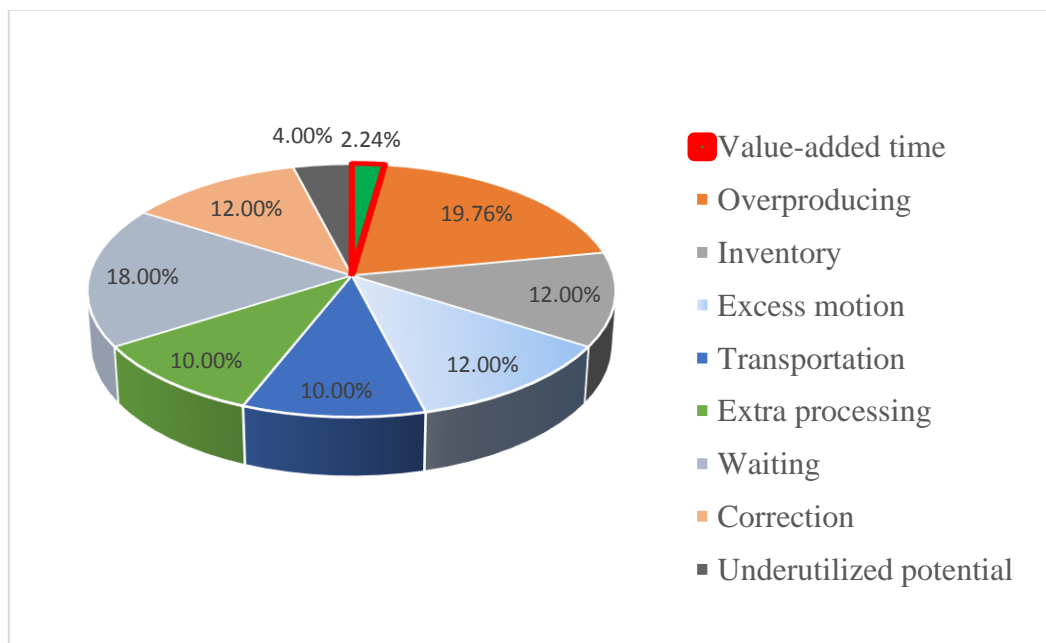
Lean measurements	Current state	Future State	Change	Change, %
Total process time (TPT), minutes	48,27	51,92	+3,65	+7%
Total order processing time (TOP), days	4,47	0,85	-3,62	-525%
Percentage of order accomplished in 8 hours	33%	120%	87%	-
DPPM, pieces per million	4487	897	-3590	-500%

From Table 7 it can be seen that due to the implemented suggestions TPT in the future state has increased for 3,65 minutes. However, despite an increased process time, TOP has decreased by 525%. This is very important because this measurement shows how long customers have to wait until their order request is processed. Due to the improvements, customers of XXX do not have to wait 4,47 days and can get their order processed within less than 1 day (0,85 days). Moreover, it allows XXX to process more orders meaning more sales and profit. DPPM has decreased by 500% that positively contributed to the change in TOP. To conclude, this shows that value stream mapping can help not only to improve numerical measurements, but also as a result to increase customer satisfaction.

It is important to remember that any Lean event, such as value stream mapping which was demonstrated above, is a tool to be used not only once, but on a regular basis as an integral part of the continues improvement pillar of Lean.

### 8.3 Project of the Implementation of 5S System

It is not an easy task to determine what is a waste in office. It is even more problematic to eliminate it. Companies that are trying to apply Lean to nonmanufacturing environment face a difficulty of not being able to use systems thinking in the process of value identification. Figure 17 shows typical wastes in an office.



**Figure 17:** Typical Office Wastes (Rotter and Shook, 2009)

Overproducing counts for 19,76%:

- printing documents or any papers before it is really needed;
- purchasing any kind of items before they are needed;
- processing work before the next person is ready to continue working on it;

Underutilized potential, 4%:

- limited authority of employees;
- lack of necessary business tools to perform work properly;

- routine task done by highly paid personnel;

Inventory – 12%:

- filled e-mail boxes, post, faxes, etc.;
- office supplies;
- not used working materials and data

Excess Motion approximately 12%:

- movements between offices;
- searching for documents;
- searching for files in computers;
- slow data insertion;
- avoidance of responsibilities;
- passing documents from hands to hand.

10% of Transportation waste:

- sending of unnecessary documents;
- wrong prioritizing;
- too much addresses in a posting list.

10% of Extra Processing:

- backup reports and other information
- inserting of repeating data
- realization of same tasks by different departments

18% of time is spent on Waiting:

- big number of obligatory signs
- dependence on co-workers

- delays in information receiving
- problems with software

12% loss of time because of defects, Correction waste:

- mistakes while data insertion
- passing of incomplete documentation to next stages
- loss of documents and information
- continuous correction of incorrect information of documents

Even though, it is impossible and not reasonable to eliminate all activities that are not directly related to the orders processing, it is necessary to decrease unproductive time hours.

The implementation of 5S tool can be started with development of a comprehensive strategy. Stages of the implementation are described in details below.

### **8.3.1 Stage 1: Preparation for the Project**

#### Goal of the project

To suggest a plan of implementing 5S System that should provide employees with a safe and quality work environment through the minimization or elimination of wastes, engagement in improvement and finally but just as important – to lay the foundation for Lean thinking.

This stage consists of three main steps:

#### *Step 1. Company management involvement.*

The top-management of the company should spare time and financial resources for the project. Timeframe of this step – 1-2 days.

The process of company management involvement:

- Choice of a leader.
- To get an approval from the top-management of the company.
- To prepare “Suggestions for 5S office project” (Appendix I)
- To fill “List of top-management obligations”

- Make corrections if necessary.

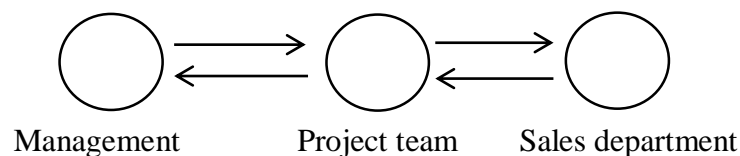
The top-management of the company must play a significant role on the first steps of programme development and later during its realization. The management of XXX has to appoint a leader who will closely work with a project team for determining aims, tasks, criteria of estimations and time of performance. Beside this, the top-managers have to attend trainings, control and conduct meetings where the achieved goals are to be discussed. Therefore, everyone in a company should take 5S seriously and believe in it.

The top-management effectively communicates on all levels of organization through the next six main activities:

- Choice of project leader.
- Determining what should be done for each project activity.
- Help in project team selection.
- Starting project up.
- Considering of all suggestions and invest.
- Audit of improvements.

The leader is the person who is responsible for the project and its realization. He will initiate activities of a project team and check the results. He will identify and overcome obstacles and be aware of the current ( i.e. real time) progress of the team.

The leader can introduce a method of a “catchball” in order to involve other participants in programme activities (Fig.18.).



**Figure 18:** Catchball (Fabrizion and Tappin, 2006)

This method is based on the principle of American game – baseball: the initiator proclaims aims, tasks and ideas and then “throws” them to other participants. This technique can be adopted during 5S implementation for creating the vision, identifying areas for improvements, needed actions and goals. Then it is send to the team that generates additional data, specifies received information and “throws” new and



processed information back to managers as regulations (statute) of a team. Statute describes project more detailed. This process is repeated till management asserts the final Statute (Fabrizio and Tapping, 2006).

*Step 2. Determine key areas.*

The aim of this step is to choose areas (offices, zones in the offices) where 5S will be adopted. This is made by the project leader in cooperation with manager of an office or other managers such as director, etc. Typical timeframe – 4-5 days.

The process of identification of key areas:

1. Determine single office zone in the company.
2. Set up agreed main functions for each zone.
3. Identify the priority of 5S implementation for each level of an area.
4. Chose the target area for 5S introduction.

There is a big number of offices in the XXX such as:

- reception
- administrative offices
- customer affairs offices (sales, marketing, supply)
- conference hall
- archives and other stores
- halls, toilets
- offices of technique and quality services
- places for receiving and shipment

The main functions depend on purposes of certain zone (Table 8).

**Table 8:** Functions of the Target Areas (Tapping, 2008)

Area	Main function	Priority
Reception	Communication center, customers meeting	2
Administrative offices	Individual offices for managers and accounting officers	3
Customer affairs offices	Place for sales managers, core company’s activities (order processing) are held here	1
Conference hall	Place for meetings and trainings	4

*Step 3. Form a team for implementation.*

The aim of this stage is to create a cross functional team for planning and adopting 5S system. The project leader will start this process and pass it to a team leader. A typical timeframe is 3-5 days.

A general team building procedure is proposed below:

1. The project leader chooses a team leader and gets an approval from the management of the company.
2. The project leader and team leader meet in order to create a first variant of the Statute of the project team and to identify the membership.
3. The team leader conducts a meeting with the project team:
  - The team leader presents a project;
  - The team leader together with the team finish the Statute (Attachment) and start the project development;
4. The team leader and project leader conduct trainings for the team in order to help them with project implementation.

The project leader must search for the best personnel able to participate in the 5S project. Once the team members are found and a team is built, the Project Manager can lead a workshop dedicated to the introduction and philosophy overview of chosen 5S method and opportunities to change the actual situation. Later the whole team may make a presentation for management about the importance of 5S introduction in offices including the information they receive from trainings.

It is estimated that project team can be built and trained within 1 month accounting for at least 20% of the workforce. In half a year the project leader can expect about 60% of trained workforce and later on almost 100% of completion of the project.

### **8.3.2 Stage 2: Office Scanning**

In order to identify current problems and to realize at which level of 5S the particular area is, where and how it should move, a 5S Maturity Matrix can be used (Appendix 3).  
Timeframe – 1-2 days.

Bresko, 2010 postulates 5 levels to represent a 'level of maturity' of the chosen area. For example, level 1 could represent an office which is just at the beginning of 5S implementation. To move from level 1 to level 2, all items in the office have to be sorted and relocated according to frequency of their usage. Frequently used items such as computer, telephone, printing machines, office supplies and few important documents needed for order processing are to be placed close to the point of use or right on the desk. This can be done in a week. Later on all items should be marked according to the places where they are to be kept. The quantity of the items must also be strictly specified for each of those places, for example no more than 2 pens on the desk and 2 folders with documents on the shelves. The numbers are estimated according to the real daily needs of sales managers. The third level can be achieved relatively quickly but the next two levels require more time and effort. This requires that the workers of the office use fewer items according to agreed specifications and keep them in order. For level 5, the order of office tools should be optimized to such an extent that any person, even someone unfamiliar with the area could find any needed item within 30 seconds. This practice is especially helpful in case if one of the employees is absent.

The next step that company should make is to address standardizing and sustaining. Otherwise the area will revert to the primer condition.

### **8.3.3 Stage 3: 1S (Sort) – Elimination of Useless Items**

*Step 4. Define the criteria for sorting things.*

The aim of this step is to set the requirements for items sorting procedure. The project team is in charge of this stage. A typical timeframe for a small office would be one or two days.

The process of the sorting procedure:

1. Develop a standard operational procedure for sorting things.
2. Create a check-list for control of sorting process
3. Develop red labels (Appendix III)
4. Create a check-list for further usage of items(Appendix .IV).

The main tasks of this stage are:

- sort everything that is in the target area;
- identify useless tools or things that are not at the right places;
- eliminate above-mentioned items from the working area.

There will be many questions that appear at the beginning, such as how to identify which items are important and which are not, what to do with all things that are not needed now but still cannot be thrown away and how often the procedure of sorting should be done.

Once the requirements are set, the process of sorting things will become clearer. Typical examples are:

Furniture that is needed in the office:

1. Desk table
2. Filing cabinet
3. Printing machine
4. Wardrobe
5. Shelves

Requirement for working place:

1. Desk table:
  - 1.1. Desk top
  - 1.2. Telephone
  - 1.3. Office supply in a box
2. Shelf:
  - 2.1. Notebooks
  - 2.2. Folders with working materials, documents
  - 2.3. Catalogues with production assortment
  - 2.4. Box for keeping small items

During the working time some personal things can be kept there as well.

3. Information desk (in front of the desk table):
  - 3.1. Contacts of colleges in the right corner
  - 3.2. Standards for working place in the left corner
  - 3.3. The calendar in the centre.

Such office supplies and documents as postcards, blanks, printing paper, empty folders, files, pens and pencils, certificates, envelopes, etc. should be sorted in separate labelled boxes and put into filling cabinet.

*Step 5. Sort things.*

Typical problems experienced by office workers in their working environment are:

- up to 30 minutes can be spent searching for right certain document, contracts, copies, etc.
- big number of folders on the table creates discomfort
- there are no free spaces for folders and documents neither on additional table nor on the shelves.

Under a 5S plan things should be sorted according to three groups: ‘need’, ‘maybe’, ‘not need’. ‘Maybe’ things should be kept or discard later. As much as 40% of the items can be removed. This step can take up to 2-3 days.

Once the step is implemented, it is necessary to conduct the evaluation of the process to find weak links and areas for improvements.

For evaluation the following method developed by Summit Business Slutions (SBS) can be used.

In order to asses next scale is used: 1- no evidence, 2 –little evidence, 3 – some evidence, 4 – high degree evidence, 5 – fully implemented (Table 9).

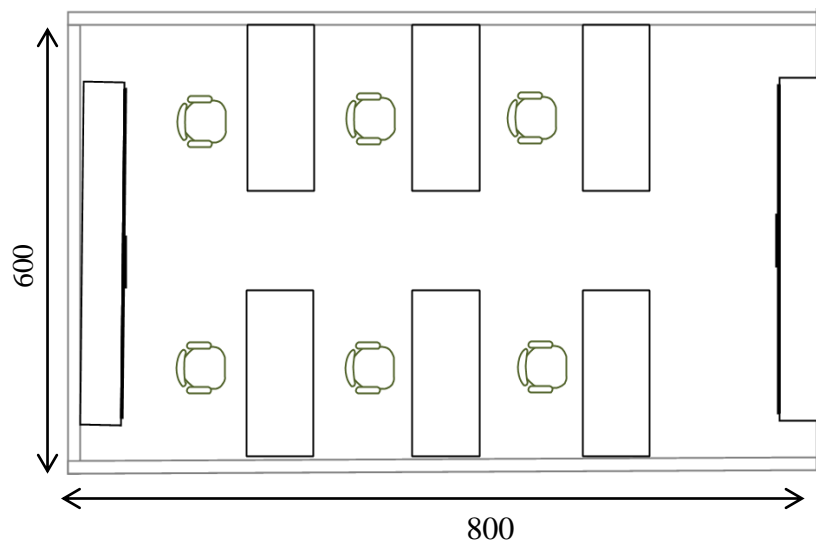
**Table 9:** Evaluation of Sort Stage Implementation (SBS)

Elements of Sort procedure	1	2	3	4	5
The steps are introduced to identify unnecessary items					
Unused equipment, furniture, documents, etc. are discarded					
Unused items on information board, walls, etc. are eliminated					
No unneeded items on the territory of the office					
No unneeded office supplies, documents, etc. in drawers, cabinets, on the tables of the office					
Subtotal					

### 8.3.4 Stage 4: 2S (Straighten/Set-in-Order) –Set thing in Order to Create Space

*Step 6. Create a map of current conditions of target area.*

The aim of this step is to utilize the space in the office more effectively. An office of sales managers which is 48 m<sup>2</sup> in total is taken as an example to show the process of 6<sup>th</sup> step implementation. There are 6 working places and two wardrobes in the office. Those places are situated one behind another with one alley in the middle of the room (Fig. 19.). Timeframe of the step – 0.5 day.



**Figure 19:** Original Office Layout (own source)

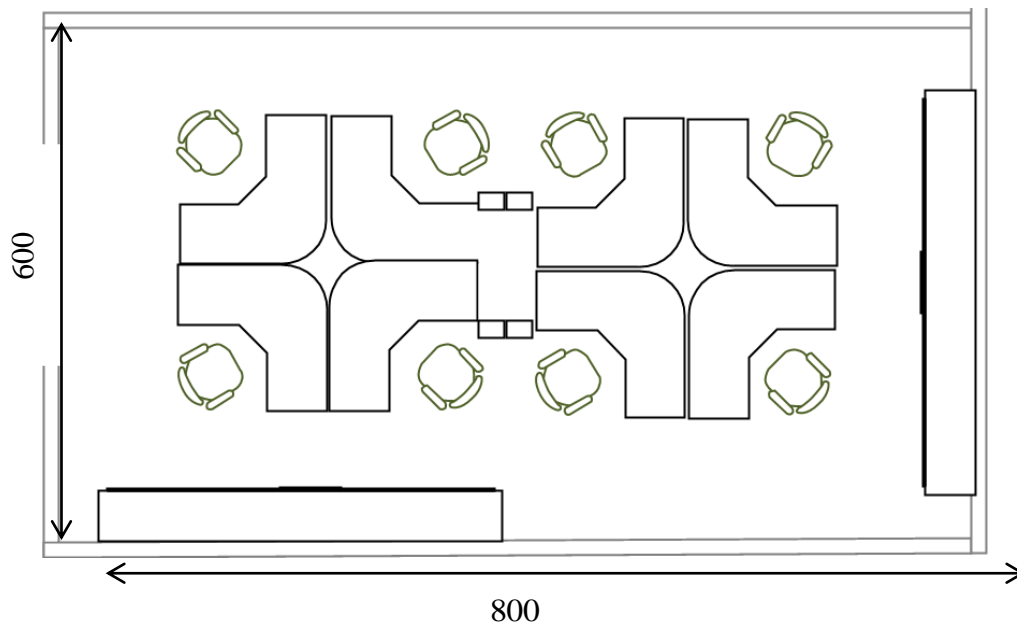
*Step 7. Develop a plan of rational placement.*

It can be seen that the usage of space is not effective. First of all, the only free space is the aisle that makes it impossible to add additional equipment or furniture. The position of desk tables is also not considered to be ergonomic. The main reason is that employees can be always distracted by the ones in front of them. In this case, it would be advisable to relocate the working places of the employees in an optimal more comfortable way.

It is estimated, that on average employees spend from 1 hour per day chatting. This is obviously a waste that should be eliminated. Partitions between tables should be set up in order to protect workers from visual and acoustical distractions and to decrease time spent in unnecessary communication. Due to these partitions, the employees would not be able to see each other seating on their workplaces. In order to discuss or pass something they will have to stand up. A person will not stand up every time to talk about something unimportant. Estimated period of completion – half a day.

*Step 8. Make a rational replacement.*

Fig. 20 shows an alternative arrangement in which the number of places in the offices increases from 6 to 8 and the additional space for essential office equipment appears next to walls (Fig. 20.).



**Figure 20:** Office Layout after Furniture Relocation (own source)

If the goal of ergonomic furniture location is achieved, the number of workplaces in the office will increase by 30%.

The best location plan should consider not only for furniture but all items. The position of often used office equipment attracts a lot of additional movements. It creates motion waste. For instance, a central multifunctional photocopier which is used by sales managers every time they need to print documents could be in another office. A possible solution would be to set up ordinary cheap printers for each working place in order to save working time.

Another step of in this stage is labelling all items and their location which is called home addresses. These home addresses are assigned for folders, electronic files/folders, office equipment, etc. This step is also a part of the standardization stage because all labels should be of one type/standard (colour, size, title) across the office or even the whole company.

It might take 10 days to accomplish the step.

Next step is Set-in-Order results' evaluation (Table 10).

**Table 10:** The Evaluation of Set-in-Order Stage Implementation (SBS)

Elements of set-in-Order procedure	1	2	3	4	5
Right locations are assigned for every item in the office					
Shared drawers, shelves, wardrobes, etc. areas are clearly labelled and well organized					
Personal drawers, shelves, desk tables are clearly labelled and well organized					
All items are placed according to assigned location					
Subtotal					

**8.3.5 Stage 5: 3S (Shine) – Keep the Working Area Clean**

*Step 9. Define the criteria of cleaning.*

The aim of this stage is to create a continuous programme of maintaining a clean business environment which would enhance productive work. The project team would develop a cleaning schedule. In this example, the sales managers would be the ones who are in charge of this step implementation.

Criteria that should be followed:

- no dust on desk tables and shelves;
- clean computer screen;
- clean floors, windows and equipment;
- all unimportant programmes in the computers are uninstalled;
- all electrical or computer wires are organised;
- no broken things in the area
- detergents and cleaning supplies are available.

Criteria of cleaning can be defined in 1-2 days.

*Step 10. Develop and implement a plan of cleaning.*

The plan of cleaning should include:

1. Creating an assignment map
2. Develop a schedule of cleaning
3. The employees should be provided with detergents and cleaning supplies that would be available all the time in the office.



The assignment map identifies the range and area of responsibilities for each employee. The schedule should be convenient for sales managers and make them know at which days they should spare some fixed time to make cleaning (Table 11).

**Table 11:** Schedule of Cleaning (SBS)

Working area	20.06	21.06	22.06	25.06	26.06	27.06	28.06	29.06	Summary
Manager 1									
Manager 2									
Manager 3									

The schedule is important because it makes sure that cleanings are done regularly and all employees from the particular sales office are involved.

The scale of employee’s cleaning performance evaluation:

- 5 and more problems – 0 points
- 3-4 problems – 1 point
- 2 problems – 2 points
- 1 problems – 3 points
- No problems – 4 points

This control list can be also considered as motivation for employees because the one with highest sum of points in the end of each month can be awarded with some bonuses (1 day-off, presents, etc.). Timeframe of the step – 1 day.

The table of Shine step evaluation is given below:

**Table 12:** The Evaluation of Shine Stage Implementation (SBS)

Elements of Shine stage process	1	2	3	4	5
Equipment, computers, desk tables, working areas are clean					
Garbage is collected and disposed properly					
E-mails and papers are filtered daily					
The office is cleaned and maintained regularly					
Subtotal					

### 8.3.6 Stage 6: 4S (Standardization) – Create Standards

This stage deals with creating standards for the previous three stages (sort, straighten and shine) so they could be preserved.

*Step 11. Develop and implement standards which indicate desirable perfect conditions.*

The implementation of previous 3 stages of 5S should become a daily routine for employees by scheduling regular activities. For instance, each employee at the end of the day should spare 15 minutes to perform 3S:

- sort things on his/her workplace and remove anything that is not needed anymore;
- put everything according to assigned location;
- throw trash away, clean the workplace and make it shine.

The question how or to which extent each activity must be performed standards should be defined. Timeframe – 1 day.

One of the standards for sorting things is a 30 second test. Every employee should be able to find any item, document or electronic file within 30 seconds. If task is not accomplished, sorting procedure should be improved. In order to gain this objective all items in the office should be labelled according to one standard. This will significantly reduce time for information searching (Tapping, 2006).

Another sorting standard is limiting a quantity of items in the office. Having this standard sales manager will always know which things and how many should be removed from the workplace.

*Step 12. Implement visualization.*

Regardless the standard type, it should be visible. This will remind employee each time that one of the 3S activities should be done, at what time and how it should be done.

The example of such visualization can be pictures of perfect or desirable conditions of the office, working place, shelves, etc. In addition, the schedule of activities must be placed in the office (for instance, on information desk on the wall) where employees may see the task assigned for every person and sign when it is done. Regular valuation of shared responsibilities and their fulfilment should be done by the management of the

company or project leader in order to improve or correct them if necessary. Timeframe – 3-5 days.

Implementation of step 12 can be assessed via Table 13.

**Table 13:** The Evaluation of Standards Implementation (SBS)

Elements of standardization stage	1	2	3	4	5
Cleaning and organizing tasks and responsibilities have been developed and assigned for the working area					
Staff is involved and fully understands 5S procedures					
5S standards are clearly displayed					
Visual management tools are introduced					
Subtotal					

**8.3.7 Stage 7: 5S (Sustain) – Maintain the Process**

5S has to become a way of thinking for the employees and thus they will be able to widen the usage of this system to other areas.

*Step 13. Educate all employees.*

Sustain is the last but not the least stage of 5S system implementation. Once the first 4 stages are adopted, the company would need to develop a comprehensive model of its preservation. Such model should include the following (Tapping, 2006):

- Regular audit of the sales office through comparing actual conditions with desirable according to the checklist
- Continuous search for ways of improvements
- Involvement of all employees of the office and the branch XXX

*Step 14. Turn 5S to a habit.*

5S system can be defined as an effective tool to improve business environment and productivity of labour. However it is not just a tool in a country of its origin – Japan, it’s an element of cultural identity. That is why the process of 5S adopting should be considered not just as new technique that requires following certain number of steps of the developed algorithm that will turn company to be highly effective at once. It should be taken as philosophy, way of thinking and behaviour. The employees of the company should develop a new habit and management must provide them with essential support and control through the process of Lean-concept implementation and after it. This

requires a lot of afford from the whole team of the company but once it is done, Lean concept and 5S system will bring expected benefits.

The assessment of the last stage (Table 14).

**Table 14:** Evaluation of Sustain Stage Implementation (SBS)

Sustain	Stick to the rules (self-discipline)	1	2	3	4	5
<b>Sustaining plans are developed to ensure accountability</b>	Everyone is involved in the improvement activities					
	Standardized cleaning and work procedures are followed					
	5S documentation and instructions are current					
	5S audits occur regularly					
	Subtotal					

*Step 15. Continue to improve.*

The 5S system can be adapted not only to business environment in offices, but for particular processes such as sales order processing, execution of documents or even the process of potential customer communication. In this example, one of the sales manager’s tasks could be to find new clients. For instance, every week a sales manager sends up to 10 information packets to potential customers. This procedure is simple but would require some time to organize all necessary documents in each folder. Sometimes it may happen that an important document is accidentally lost or forgotten by person who is a temporary replacement or who doesn’t do this task that often. If the incomplete package is sent to a customer that might cause the slowdown of sales process. That is why it is vital to standardize this process and make it easy to complete.

In order to standardize the process of package sending next steps should be done:

- Create a checklist for all papers and documents that might be in the package
- Make a picture of ready package
- Locate the documents for package in labelled folders on a shelf
- Locate checklist and picture next to folders with documents.

The continues improvements of all 5S stages, setting new goals and achieve them, thinking of what else can be improved, how to preserve what is already done are the key factors of successful 5S implementation which will bring expected benefits.

*Step 16. 5S assessment*

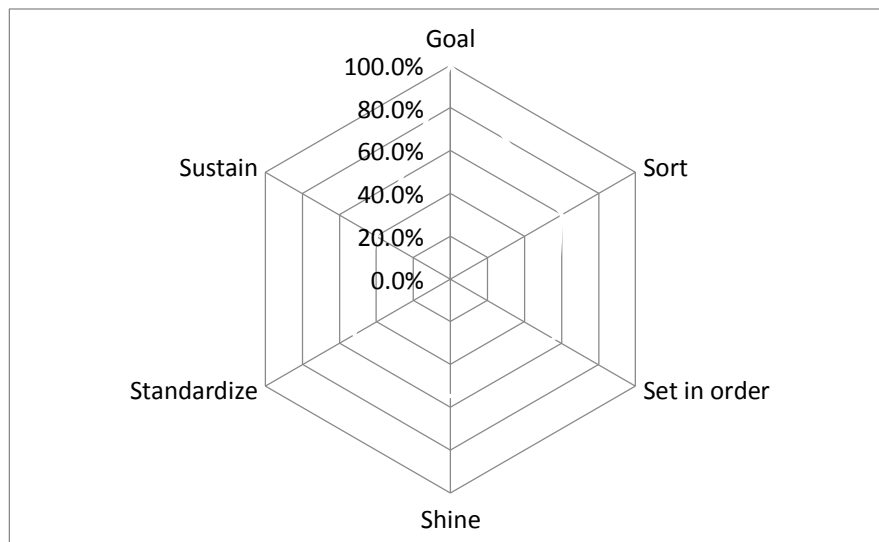
Once the data of all stages' evaluation is collected it is possible to assess the results of 5S introduction and adoption in the company in order to determine at which step of process the company is and what should be improved.

The data from the previous evaluations (all Subtotals) of all 5S stages has to be summarized in the Table 15.

**Table 15:** The Overall Assessment of 5S Implementation (SBS)

Process	Total Score	Percentage, %
Sort		
Set in order		
Shine		
Standardize		
Sustain		

In order to visualize the results of 5S utilization the data from the Table 15 should be displayed on radar chart (Fig. 21).



**Figure 21:** 5S Overall Assessment (SBS)

It is very difficult to tie materials and time spent on 5S to some direct benefit as, for example, return on investment. Implementation of 5S by other companies brought such positive outcomes as cleaner workplaces that reduce number of accidents, improved

morale and productivity of the employees, great help and support for other Lean activities.

### **8.3.8 Risks of the project of implementing 5S System**

1. Employees can initially resist against making changes in a well-established workplace. They can resist against both physical and cultural changes. One may say that things have always been done like that.

*Risk mitigation:* As in any activity related to improvement, communication is critical. Analysis should be conducted to find out areas of possible resistance and specific strategies are to be devised to decrease the opposition. Resistance during the implementation has to be searched for and when it is found, management should confront it in a positive manner through honest and open conversation.

2. Not addressing problems in the workplace

*Risk mitigation:* It is necessary to be sure that 5S is used to address real and actual problems. Each organization has to work out its own 5S system following the general steps of it.

3. New rules can be taken not seriously.

*Risk mitigation:* New rules have to be enforced. When a standard is set there cannot be any variation unless other standard is accepted. Managers have to control it.

4. Things can slowly return to the "old ways" of doing after the initial launch focus is gone.

*Risk mitigation:* New ways of working and standards require time to become a habit. Tangible reminders, such as photography of past states, have to be always communicated to show how better things are at the moment due to 5S. 5S can be maintained only with a strong management commitment that insures formalisation of new standards and rules.

5. Not understanding what 5S does

*Risk mitigation:* It should be well explained that 5S cannot solve every problem in workplace. It is just one of many Lean tools and to achieve enormous changes, a group of tools has to work synergistically.

To conclude, the 5S System is a very simple yet valuable aid to Lean improvement. However, it is recommended to keep the improvements going and have regular monitoring in order to achieve sustainability.

## CONCLUSION

The master's thesis has researched and focuses on a methodology to improve business performance of Metinvest Holding, LLC through the application of appropriate Lean techniques within their office environment.

Lean originated in the manufacturing plants of Toyota, but today it is widely used in various non-production spheres. A detailed research into the theoretical background of Lean concept has been carried out in order to ascertain the Lean tools applicable for the utilization in the administrative area.

In the analysis part, a general review of Metinvest Holding, LLC was given. It was revealed that the company already used Lean in its production and a strategic model of introducing Lean Office was suggested as a next step of Lean transformation. The model consists of three components (Methodology, Implementation Model and Lean Production System Review Process.) which are described in detail in the sixth chapter. It was discovered that an important feature of Lean implementation and transformation processes is to provide employees with a proper information about every Lean-related aspect to avoid problems in future. This can be achieved by means of the proposed Programme of Lean Training that covered such Lean topics as visual management, standardized operations, Kaizen, wastes, and problem solving.

A Value Stream Mapping technique was proposed to tackle a problem with order processing that arose in one of the Metinvest's branches. The figures used show a decrease in the total order processing time from almost five days to less than one day. This, in turn, would allow them to proceed faster with requests of customers and thus increase their satisfaction. Afterwards, an example of how to implement a 5S System was presented. 5S implementation is a simple but long-term process and it can improve the working conditions in the administrative areas.

To conclude, the work shows that to really achieve the considerable benefits from implementing Lean in its totality, it is needed to perform Lean events not just once or twice in form of a tactical tool, but on a regular basis as an incremental part of the company's strategy.



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**LIST OF ABBREVIATIONS**

TPS	Toyota Production System
NUMMI	New United Motor Manufacturing Inc.
IMVP	International Motor Vehicle Program
GM	General Motors
MIT	Massachusetts Institute of Technology
LPD	Lean Product Development
UK	The United Kingdom
IT	Information Technology
VSM	Value Stream Map
SC	Spaghetti Chart
CIS	The Commonwealth of Independent States
SCM	System Capital Management
CEE	Central and Eastern Europe
MBM	Metinvest's Business Model
EBITDA	Earnings before Interest, Tax, Depreciation and Amortisation
SEA	South East Asia
MENA	Middle East and Northern Africa
CFO	Chief Financial Officer
CSR	Corporate Social Responsibility
SOS	Standard Operation Sheet
SA	Service Agent
PT	Process Time
TPT	Total Process Time
QT	Queue Time



TLT	Total Lead Time
DPPM	Defective Parts per Million
TT	Takt Time
TOP	Total Order Processing Time

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## **APPENDICES**

**APPENDIX I: FORM FOR SUGGESTIONS FOR 5S OFFICE PROJECT**

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**APPENDIX I: FORM FOR SUGGESTIONS FOR 5S OFFICE PROJECT  
(FABRIZIO AND TAPPING, 2006)**

<b>Suggestions for 5S office project</b>	
1.	Full name of the head of the company:
2.	Mission:
3.	Areas:
4.	Processes:
5.	Correspondence with company strategy
6.	Approximate timeframes/duration: <ul style="list-style-type: none"><li>• Start</li><li>• Finish</li></ul>
7.	Budget <ul style="list-style-type: none"><li>• trainings/implementation time</li><li>• special equipment</li><li>• other</li></ul>
8.	Questions, obstacles and difficulties that should be considered

**APPENDIX II: STATUTE OF THE PROJECT TEAM (FABRIZIO AND TAPPING, 2006)**

<b>Statute of the Project Team</b>		
<b>Name of the team:</b>	5S project team	
<b>The goal of the team:</b>	To organize efficient working environment, to eliminate wastes and unproductive time	
<b>Team members:</b>	Project leader: Team leader:	Members of the team:
<b>Timeframe:</b>	Start:	Planned finish:
<b>Plan of actions:</b>		
<ol style="list-style-type: none"> <li>1. Liquidate documents/papers that are not needed</li> <li>2. Create a list of necessary things</li> <li>3. Create a store and system of fast document searching</li> <li>4. To standardize the processes in the offices</li> <li>5. Introduce visual control in order to preserve established system.</li> </ol>		
<b>Comments:</b>		
The budget issues to be assigned by quality control manager		

**APPENDIX III: RED TAG (FABRIZIO AND TAPPING, 2006)**

<b>Red Tag</b>		
<b>Issue:</b>		<b>Tag #</b>
<b>Action needed</b> (circle one and add comments if necessary) <b>1. Throw Away    2. Organize    3. Improve    4. Resolve    5.</b> <b>Other</b>		
<b>Date of tag:</b>	<b>Category (if appropriate):</b>	<b>Date of completion:</b>
<b>Tagged by:</b>	<b>Assigned to:</b>	<b>Reviewed by:</b>
<b>ACTION TAKEN:</b>		

## APPENDIX IV: 5S CHECKLIST (Hiroyuki, 1995)

Principe	#	Actions	Date	Score
<b>Sorting</b>	<b>1</b>	No unnecessary folders, documents, office supplies		
	<b>2</b>	Irrelevant items or documents can be identified at a glance		
	<b>3</b>	Removing items from the aisle		
<b>Set in order</b>	<b>4</b>	All items are put in the right places		
	<b>5</b>	Working areas are clearly defined		
	<b>6</b>	Places for all items are assigned		
<b>Shine</b>	<b>7</b>	Desk tables, shelves, drawers are clean from dust		
	<b>8</b>	Desk top's monitors are clean		
	<b>9</b>	Detergents and cleaning supplies are available		
	<b>10</b>	Red tags are available		
<b>Standardize</b>	<b>11</b>	Standards are visualized		
	<b>12</b>	Education of employees		
	<b>13</b>	Items in working areas are easy to find		
	<b>14</b>	Checklists and schedules are available		
<b>Sustain</b>	<b>15</b>	Controlling is carried out regularly		
	<b>16</b>	Suggestions of improvements are generated and implemented		



**APPENDIX V: 5S MATURITY MATRIX (Bresko, 2005)**

<b>5S Levels of Achievement</b>					
<b>Level V: Continuously Improve</b>	Cleanliness problems are identified and mess prevention actions are in place.	Needed items can be retrieved within 30 seconds and require a minimum number of steps.	Potential problems are identified and counter measures are documented.	Reliable methods and standards for housekeeping, daily inspections and workspace arrangement are shared and are used throughout similar work	Root causes are eliminated and improvement actions focus on developing preventive methods
<b>Level IV: Focus on Reliability</b>	Work area has documented housekeeping responsibilities and schedules and the assignments are consistently followed.	Needed items in work area are minimised in number and are properly arranged for retrieval and use.	Inspection occurs during daily cleaning of work areas and equipment and supplies	Reliable methods and standards for housekeeping, daily inspections and workplace arrangement are documented and followed by all members of the work group.	Sources and frequency of problems are documented as part routine work, root causes are identified, and corrective action plans are developed.
<b>Level III: Make it Visual</b>	Initial cleaning has been performed and sources of spills and messes are identified and corrected.	Needed items are outlined, dedicated locations are properly labelled and required quantities are determined.	Visual controls and identifiers are established and marked for the work area, equipment, files and supplies.	Work group has documented agreements on visual controls, labelling of items and required quantities of needed items.	Work group is routinely checking area to maintain 5S agreements.
<b>Level II: Focus on Basic</b>	Needed and not-needed items are identified. Those not needed are removed from work area.	Needed items are safely stored and organised according to frequency of use.	Key work area items to be checked and identified and acceptable performance levels documented.	Work group has documented agreements for needed items, organisation and work area controls.	Initial 5S level has been determined, and performance is documented and posted in work area.
<b>Level I: Just Beginning</b>	Needed and not-needed items are mixed throughout the work are.	Items are placed randomly throughout the workplace.	Key work area items checked are not identified and are unmarked,	Work area methods are not consistently followed and are undocumented.	Work area checks are randomly performed and there is no visual measurement for 5S.
	<b>Sorting</b>	<b>Simplifying</b>	<b>Systematic Cleaning</b>	<b>Standardizing</b>	<b>Sustaining</b>