Train2Sustain – developing capacity to teach sustainability in VET

Unit 6

Lean Management

Projektnummer: 2020-1-FI01-KA202-066632

Autor: bit schulungscenter

Co-funded by the Erasmus+ Programme of the European Union

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Index

Co-funded by the Erasmus+ Programme of the European Union

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Glossary

Glossary for Units 1 – 7 ALPHABETIC ORDER

Artificial intelligence	**Artificial intelligence** (**AI**) is intelligence—perceiving, synthesizing, and inferring information—demonstrated by machines, as opposed to intelligence displayed by non-human animals and humans. Example tasks in which this is done include speech recognition, computer vision, translation between (natural) languages, as well as other mappings of inputs.
Biocapacity	The **biocapacity** or **biological capacity** of an ecosystem is an estimate of its production of certain biological materials such as natural resources, and its absorption and filtering of other materials such as carbon dioxide from the atmosphere
Biodiversity	**Biodiversity** or **biological diversity** is the variety and variability of life on Earth. Biodiversity is a measure of variation at the genetic (genetic variability), species (species diversity), and ecosystem (ecosystem diversity) level.
Carbon footprint	A **carbon footprint** is the total greenhouse gas (GHG) emissions caused by an individual, event, organization, service, place or product, expressed as carbon dioxide equivalent (CO_2e)
Carbon handprint	A carbon handprint is **the opposite of a footprint**. It recognises the actions you take to have a positive impact on the climate, over and above reducing your own carbon footprint if you do enough of these, they might even outweigh the size of your carbon footprint.
Circular economy	A **circular economy** is a model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing, and recycling existing materials and products as long as possible
Decarbonization	The term decarbonization literally means **the reduction of carbon**. Precisely meant is the conversion to an economic system that sustainably reduces and compensates the emissions of carbon dioxide (CO_2)
Deforestation	**Deforestation** or **forest clearance** is the removal of a forest or stand of trees from land that is then converted to non-forest use.[3] Deforestation can involve conversion of forest land to farms, ranches,

Co-funded by the Erasmus+ Programme of the European Union

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

	or urban use. The most concentrated deforestation occurs in tropical rainforests
Eco-design	**Ecological design** or **ecodesign** is an approach to designing products and services that gives special consideration to the environmental impacts of a product over its entire lifecycle
Ecological footprint	The **ecological footprint** is a method promoted by the Global Footprint Network to measure human demand on natural capital, i.e. the quantity of nature it takes to support people and their economies.
Energy-efficient	Energy efficiency is **the use of less energy to perform the same task or produce the same result**. Energy-efficient homes and buildings use less energy to heat, cool, and run appliances and electronics, and energy-efficient manufacturing facilities use less energy to produce goods.
Environmentally friendly	**Environment friendly processes**, or **environmental-friendly processes** (also referred to as **eco-friendly**, **nature-friendly**, and **green**), are sustainability and marketing terms referring to goods and services, laws, guidelines and policies that claim reduced, minimal, or no harm upon ecosystems or the environment.
European circular economy action plan	The EU's Circular Economy Action Plan (CEAP) was **a comprehensive body of legislative and non-legislative actions adopted in 2015, which aimed to transition the European economy from a linear to a circular model**. The Action Plan mapped out 54 actions, as well as four legislative proposals on waste.
Fertilisers	**Fertiliser** is any material of natural or synthetic origin that is applied to soil or to plant tissues to supply plant nutrients.
Fossil fuels	A **fossil fuel** is a hydrocarbon-containing material formed naturally in the Earth's crust from the remains of dead plants and animals that is extracted and burned as a fuel. The main fossil fuels are coal, oil, and natural gas.
Greenhouse emission	**Greenhouse gas emissions** from human activities strengthen the greenhouse effect, contributing to climate change. Most is carbon dioxide from burning fossil fuels: coal, oil, and natural gas. The largest emitters include coal in China and large oil and gas companies.
Greenwashing	is a form of advertising or marketing spin in which green PR and green marketing are deceptively used to persuade the public that an organization's products, aims and policies are environmentally friendly.

Co-funded by the Erasmus+ Programme of the European Union

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Holistic process	**relating to or concerned** with wholes or with complete systems rather than with the individual parts.
Innovation	**Innovation** is the practical implementation of ideas that result in the introduction of new goods or services or improvement in offering goods or services
Lean management	**Lean manufacturing** is a production method aimed primarily at reducing times within the production system as well as response times from suppliers and to customers.
Lean principles	The five principles are considered a recipe for improving workplace efficiency and include: 1) defining value, 2) mapping the value stream, 3) creating flow, 4) using a pull system, and 5) pursuing perfection.
Linear economy	The traditional model where raw materials are collected and transformed into products that consumers use until discarding them as waste, with no concern for their ecological footprint and consequences.
Muda, Mura, Muri	**Muda, mura and muri** are three types of wasteful actions that negatively impact workflow, productivity and ultimately, customer satisfaction.
Organic farming	Organic farming, also known as ecological farming or biological farming, is an agricultural system that uses fertilizers of organic origin such as compost manure, green manure, and bone meal and places emphasis on techniques such as crop rotation and companion planting.
Pesticides	In general, a pesticide is a chemical (such as carbamate) or biological agent (such as a virus, bacterium, or fungus) that deters, incapacitates, kills, or otherwise discourages pests
Product Life cycle	Product life-cycle management is the succession of strategies by business management as a product goes through its life cycle. The conditions in which a product is sold changes over time and must be managed as it moves through its succession of stages.
Product-as-a-service	Product as a service is the concept of selling the services and outcomes a product can provide rather than the product itself.
Pull production	**A method of production control in which downstream activities signal their needs to upstream activities**. Pull production strives to eliminate overproduction and is one of the three major components of a complete just-in-time production system.

Co-funded by the Erasmus+ Programme of the European Union

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Recycling	**Recycling** is the process of converting waste materials into new materials and objects. The recovery of energy from waste materials is often included in this concept. The recyclability of a material depends on its ability to reacquire the properties it had in its original state
Renewable energy	**Renewable energy** is energy that is collected from renewable resources that are naturally replenished on a human timescale.] It includes sources such as sunlight, wind, the movement of water, and geothermal heat
Sustainability	**Sustainability** is a societal goal that relates to the ability of people to safely co-exist on Earth over a long time.
Sustainable household	A sustainable home is **one that is built or retrofitted in a way that conserves resources, optimizes energy and water use and that will last longer with quality systems**. A sustainable house is built with low-impact, high-performance materials. They are efficient in terms of manufacturing, shipping, and installing.
Sustainable label	Eco labels **set minimum environmental and health standards and verify products that meet the criteria**. They're designed to inform consumers, brands, and manufacturers that labelled products are more environmentally friendly than most.
Sway	Sway is a digital storytelling app that helps you create professional, interactive designs for your images, text, videos, and other media in minutes.
The 5s	5S stands for the 5 steps of this methodology: **Sort, Set in Order, Shine, Standardize, Sustain**. These steps involve going through everything in a space, deciding what's necessary and what isn't, putting things in order, cleaning, and setting up procedures for performing these tasks on a regular basis.
The European action Plan	It aims to: Re-orient capital flows towards sustainable investment, in order to achieve sustainable and inclusive growth; Manage financial risks stemming from climate change, natural disasters, environmental degradation and social issues; and. Foster transparency and long-termism in financial and economic activity.
Value chain	A **value chain** is a progression of activities that a firm operating in a specific industry performs in order to deliver a valuable product (i.e., good and/or service) to the end customer.

Co-funded by the Erasmus+ Programme of the European Union

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Value stream	A **value stream** is the set of actions that take place to add value to a customer from the initial request through realization of value by the customer. The value stream begins with the initial concept, moves through various stages of development and on through delivery and support. A value stream always begins and ends with a customer.
Waste management	**Waste management** or **waste disposal** includes the processes and actions required to manage waste from its inception to its final disposal. This includes the collection, transport, treatment and disposal of waste, together with monitoring and regulation of the waste management process and waste-related laws, technologies, economic mechanisms.

Co-funded by the Erasmus+ Programme of the European Union

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

1 Introduction to Lean Management

Indicator

Before you start introducing Lean to your students, it's advisable that you can take a pre-visit to an industrial facility experienced in Lean, to get to know better its concepts and applicability.

Introduction

Kiichiro Toyoda was the son of Sakichi Toyoda, who started Toyoda Loom Works in 1926. This company created manual and machine-powered looms, increasing productivity within the textile industry. In 1933, the company established its automobile department, led by Kiichiro Toyoda. A few years later, in 1937, they decided to rename their company to Toyota for a few reasons. The first reason was that people thought it sounded better. The main reason for spelling it with a "T" instead of a "D" is because the word Toyoda in Japanese uses 10 strokes of the pen to write, whereas Toyota only uses eight. Eight is considered to be a lucky number in Japanese culture, so the name Toyota was chosen.

In the manufacturing of products or the carrying out of services, there can be a tremendous amount of waste of raw materials, time, money, energy etc. Precisely to prevent this and to make the production process as cost-effective, as fast and as little wasteful as possible, Lean Management was introduced. Lean Management goes back to the Toyota Production System (TPS) developed in the 20th century and is intended to help make the processes within a company as efficient as possible. But what exactly does Lean mean, where does this term come from and what benefits does it bring to both companies and the environment? You will learn about all these aspects in this learning unit.

Figure 1. a well organized beauty salon wardrobe

In this unit, after a basic definition of Lean Management and highlighting some of its characteristics, you will learn about the 5 principles of Lean and how they affect organisations that apply these principles. You will then learn about the 5S in relation to Lean Management, their goals and benefits, and see what factors influence these 5S. Furthermore, you will get an overview of the seven types of waste in Lean Production and we will show you how to reduce or eliminate

Co-funded by the Erasmus+ Programme of the European Union

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

them. Finally, you will learn how Lean Management is related to sustainability and how the processes in a Lean system can contribute to a more sustainable supply chain.

Practice

To give your students a better understanding of Lean issues, you could play the pen game (activity A11) in your classes. It is about a production line of pens that should be improved by the students in relation to Lean issues.

You can find the instructions as well as supporting documents of this activity A11 "Pen Game" here: https://www.train2sustain.eu/instructors/

Hint: You could play round 1 of this game right here at the beginning of this Lean content unit where the students do not have any information about Lean. But it is suggested to play round 2 and 3 after learning these Lean contents so that it is easier for the students to find efficient solutions within the game.

Co-funded by the Erasmus+ Programme of the European Union

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

2 Lean Principles

What exactly does Lean mean and how did this term emerge? Lean is a term from management theory and comes from Japan. The beginnings of this management system go back centuries, but the real fundament for Lean was laid in the 20th century by Henry Ford, when he started developing the T-model, standardized manufacturing processes, introduced a moving assembly line and was thus able to start mass production. These elements were taken up by the Toyoda brothers and they developed the **Toyota Production System (TPS),** which forms the **basis of the Lean approach.**

Remember

Lean Management emerged through the development of the Toyota Production System (TPS). The **focus** of this system was **on optimizing production processes, material and information flows**. As there was relatively little capital available, ways had to be found to move material through the value chain as quickly and cheaply as possible, but still, keep quality high in order to survive despite competition.

As already mentioned, Lean Management refers to the fact that **processes in a company should be designed as efficiently as possible**, in other words with as little effort as possible. Waste should be reduced, and quality should increase at the same time. This approach is characterized by the **constant search for ways to improve work processes.** The error culture is also special in the context of Lean Management, as errors are not punished but seen as an opportunity for improvement.

The **objectives** of implementing Lean Management are the following:

- Manufacturing products at the lowest possible cost
- Reduction of throughput time in production
- Producing end products that have a high level of quality

These goals are to be achieved by **avoiding waste (muda), irregularities (mura) and excessive burdens (muri).** You will learn more about the different types of waste in chapter 1.4 "8 Wastes of Lean".

Why it is worthwhile to work according to the Lean Principle, you can see below:

- Activities without value are reduced and the focus is placed on value-creating activities.
- Productivity and efficiency of a company are increased
- Existing resources are better utilized
- Work is only done when it is really necessary
- Companies can react more flexibly and quickly to orders
- The focus is always on improving overall performance

To be able to design work processes as efficiently as possible, companies that operate according to this approach **focus very strongly on their customers**. Because only if a company knows what its customers want and in which form, it can avoid waste.

Co-funded by the Erasmus+ Programme of the European Union

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

The fields of Lean Management applications are diverse. As you have already learned, the beginning of Lean can be traced back to the manufacture of motor vehicles, which is why Lean was originally aimed at improving production processes. But in today's world, a **Lean system can be applied to many** other **areas** as well, such as:

- Administration
- Logistics
- Maintenance

The ways in which it can be applied vary greatly: Lean can be implemented both on workbenches in production and at the office desk, e.g. in accounting. Basically, all areas in a company can be improved and made more efficient. In addition, Lean Management can also be found in a wide variety of industries, from the automotive industry to the health, construction and IT sectors, to various service companies. Here are some examples of organizations that work according to Lean principles and thus increase their productivity:

Figure 2. Organizations working according to Lean Principles

But which principles are we talking about in the context of Lean? In order to follow a Lean Management structure, **five principles**, outlined by Mr. Womack and Mr. Jones in their book "Banish Waste and Create Wealth in Your Corporation", should be considered to help **increase efficiency and eliminate waste** - which is what Lean is all about:

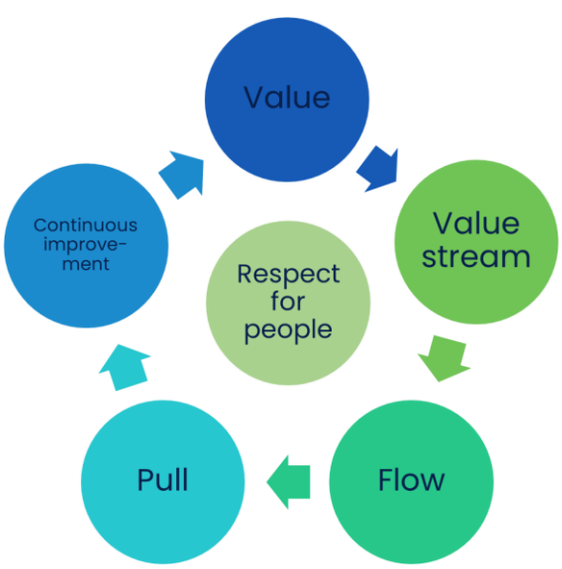


Figure 3. The 5 Lean Principles

Co-funded by the Erasmus+ Programme of the European Union

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Value

For a company to be successful in the market, it is necessary to find out the needs of the customers and to **produce products/services** that have value for them and **for which they are willing to pay** a certain price. The products must solve a problem. All those activities and processes that do not increase the value of an object and are not absolutely necessary are to be seen as waste and should be prevented.

Value Stream

After the value produced in an organisation has been determined, it is important to clearly **show how the value reaches the customers**. This value chain, which begins with the order and ends with the delivery of the product or the execution of the service, should be visualised separately for each product group and for each service. In this way, it is possible to get an overall view of all work processes, to improve them and to reduce wasteful activities.

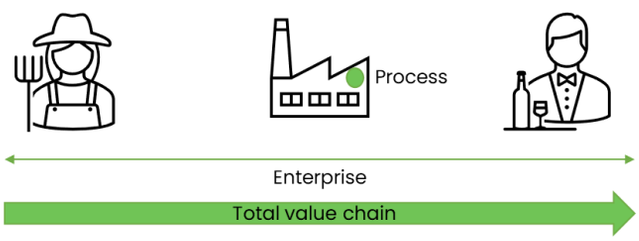


Figure 4. Value stream representation

Flow

The work processes within a company should be designed in such a way that a **continuous flow** is possible. This means that standstills or waiting times should be avoided so that as many products can be produced as quickly as possible. This flow is made possible by adhering to the **5S**. It is important that the workplace is kept as organized and clean as possible. These 5S will be discussed in more detail in the next chapter. Through this continuous flow, work can be done as cost-effectively as possible, and products can be delivered without long delays.

Pull

In order to avoid waste, only those **processes** should be carried out and **products** produced **that are actually demanded by the customers** and for which sufficient capacities are available in the company. After a task is completed, the next task with the highest priority is started by the respective employee. The time taken to complete a task should be kept short so that as many tasks as possible can be completed. This system allows a company to minimize stock levels and waste.

Perfection/continuous Improvement

An integral part of the Lean concept is continuous improvement and the **pursuit of perfection**. All work processes that bring great value to the customers should always be improved, whereas those tasks that do not add value should be eliminated as much as possible. This continuous improvement and pursuit of perfection are also called **KAIZEN** in Japan.

Co-funded by the Erasmus+ Programme of the European Union

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

This last principle is strongly dependent on the employees because they must also be willing to take responsibility for and carry out the improvement processes. Continuous improvement can be achieved, for example, through the **PDCA cycle** (Plan - Do - Check - Act).

Indicator

Watch the following video in order to better understand these 5 principles:
https://www.youtube.com/watch?v=Cc490OnqIK4

A very important aspect in the implementation of a Lean strategy is the **involvement of the employees.** They need to understand the principles behind Lean and the goals and actions associated with it. If this management system is supported by the entire workforce and these five principles are implemented, it is possible to identify unnecessary processes, save costs and working time, meet customer needs on time and thus generate a competitive advantage.

Co-funded by the Erasmus+ Programme of the European Union

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

3 5S of Lean

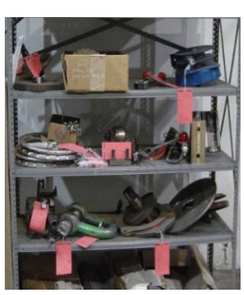
In the context of Lean Management, the principle of the 5S has also been introduced. This method was again first used in Toyota production, but in the meantime, like Lean in general, it can also be found in other areas such as administration. But what exactly is the 5S method and what is it all about? These are the questions we will explore in this chapter.

The 5S represents **five work steps that are carried out to optimize working environments as well as processes:**

Figure 5 – The 5S steps

Sort (Seiri 整理)

This is about **sorting out any items that are no longer needed**. All those objects that are no longer needed are marked (given a so-called "red tag") and then removed. At the end of this step, there should only be as few objects at the workplace as are actually needed to carry out the work. This provides a better overview of the working environment and more space is created for the important things.



Set in order (Seiton 整頓)

All **items** that remain after the sorting out, such as tools or equipment, **are systematically arranged at the workplace**. The order can be based on various criteria, such as frequency of use, order of use or ergonomics. To simplify this order and to make it clear to people who rarely work at the workplace, it is important to clearly mark all items and their storage locations.

Useful questions that you can ask yourself to help you organize are:

- What do I need most often to do my job?
- Where should I store the work tools so that it makes the most sense for my job?
- How much of the same work equipment do I need?

Shine (Seiso 清掃)

Co-funded by the Erasmus+ Programme of the European Union

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

After sorting out non-essential items and arranging the rest, it is important to **clean the workplace** and keep it clean at all times. This is the only way to detect and remedy defects in the products at an early stage. In this step, it is also important to find out how soiling occurs and to develop a plan to prevent it as much as possible. Keeping the working environment clean at all times contributes positively to the motivation and well-being of employees, in addition to enabling them to work more efficiently.

Standardise (Seiketsu 清潔)

However, the activities already mentioned should not only be implemented at one workplace but, if possible, across all areas. In addition, the procedure for this should be standardized, i.e. there should be **uniform procedures and specifications for all work areas.** This standardization can take place, for example, by means of the positioning of work equipment. Furthermore, different color codes can also be used at all workplaces, e.g. for walkways, delivery areas or pick-up areas. This standardization makes it easy to quickly find one's way around a work area, even after a change of workplace or when training new employees, for example. Standardized procedures can also be used for cleaning. It is important to control these standardizations, e.g. by means of checklists.

Sustain and self-discipline (Shitsuke 躾)

For this last work step, all employees in a company are responsible. Only through the **self-discipline of all people involved** it is possible to implement all the aspects mentioned and to work as efficiently as possible. In order to **maintain these activities**, also involves, among other things, passing on clear instructions to the employees, e.g. in the form of posters or pocketbooks, constantly reviewing the processes and introducing improvement measures if necessary.

Co-funded by the Erasmus+ Programme of the European Union

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Example

Let's take a carpentry with different tools as an example. Often a workbench in a carpentry looks like this:

All tools are lying in a mess on the workbench. In order to be able to organize work processes more efficiently, it is necessary to a first step to removing everything that is not needed in the workspace as well as waste. Then the tools should be organized. Here, for example, you could place the tools that you need most often in a way that they are quickly at hand. Once the workbench is tidy, it should be cleaned. All these steps should be standardized with the other workplaces in carpentry. If this is the case, all work areas could look like this:

If all employees have the self-discipline to implement all these steps all the time, time and costs can be saved at work in the long term and quality and productivity can be increased.

You have already read about the 5S briefly in chapter 1.2 "Lean Principles". There it was briefly mentioned that they are implemented to ensure a continuous flow within a company. In detail, this method can have the following **positive effects on an organization:**

- Increase in efficiency and quality
- Easy identification and elimination of wastage
- Creation of a clear, clean, safe and ergonomic workplace
- Increase of employee well-being and satisfaction in the workplace
- Increase in productivity and reduction of disruptions
- Better use of space
- Visualisation of successes

The **main objective** of the 5S method is to create working environments that enable the **manufacturing of products/services with the best quality, in the shortest time and with maximum safety**. Activities that do not add value and represent waste are to be minimised by means of this method.

The following factors can influence the success of the 5S:

- Strategy and behaviour of the management
- Transparency and comprehensibility of the measures to be implemented
- Existence of the necessary prerequisites and capacities (waste containers, labeling equipment, sufficient time, etc.)
- Motivation of employees to implement the 5S

Co-funded by the Erasmus+ Programme of the European Union

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

In order to achieve the above-mentioned goals and to benefit from the advantages of this 5S method in the long term, it is important to permanently **integrate the 5S** and all associated measures into the corporate culture and **into the everyday work of the employees**.

Indicator

To show the extent to which compliance with the 5S can help increase efficiency, the so-called "numbers game" can be played: http://leantools.info/5sgame/

Co-funded by the Erasmus+ Programme of the European Union

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

4 7 Wastes of Lean

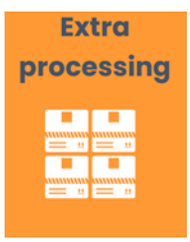
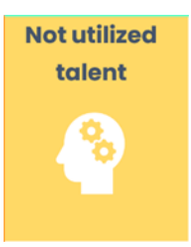
As you have already learned, **Lean Management focuses on minimising all kinds of waste**, i.e. everything that does not bring value to customers and for which they are not willing to pay anything. Such waste can occur in various facets. As part of the Toyota Production System, the **model of eight types of waste** has been introduced. Each of them contributes to the fact that processes and workflows in a company do not run as efficiently as they could. You will learn more about these seven types of waste in the following explanations.

7 Wastes of Lean

	Defects Defects due to poor quality are also seen as a waste, as they lead to rework and thus take up valuable time and resources. In the worst case, even the entire production process has to be run a second time. Therefore, constant improvement must be ensured, the causes of defects must be eliminated, defect rates reduced and **quality maintained at a high level**.
	Overproduction As you have already read, anything that does not bring value to customers is a waste. Thus, everything that is produced without being demanded by anyone is also a kind of waste, as both time and money are invested in production and storage. In order to avoid this, a **just-in-time concept and synchronization of the processes with the customers' needs** are useful.
	Waiting Waiting times that often occur in companies, e.g. when products are waiting to be delivered or a document is waiting for a certain person to sign, are also seen as waste since no value is created during these times. Therefore, it is important to plan processes in such a way that **as few waiting times as possible** occur.
	Inventory This aspect refers to everything that is in a company's inventory, e.g. raw materials or intermediate products. All things that are not currently needed and are in stock cause additional costs and tie up capital, which can be seen as a waste. Therefore, the goal is to **reduce stocks so that just the current demand can be met.** In order to avoid this kind of waste, it is possible to switch to just-in-time deliveries, for example.

Co-funded by the Erasmus+ Programme of the European Union

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

	Transportation The transport of raw materials, intermediate products, etc. leads to personnel and energy costs, results in waiting times and jeopardises the quality of the end product. Therefore, the **transport distances** as well as the transport **frequency should be kept as low as possible**. This can be done, for example, by designing the workstations in such a way that transports are avoided (example: arranging the production chain in a U-shape).  Source: http://leanop.com/cms/en/glossary/
	Motion This aspect refers to unnecessary movements of people, machines or work equipment. Each of these movements takes time and could lead to injuries. Therefore, it is important to take measures to simplify the work for staff and to ensure their health and safety. To **reduce movements**, care should be taken to organize the workplace well and to place work equipment as close to the work area and as ergonomically as possible.
	Extra processing This type of waste refers to work that is done without adding value, or that adds value that customers do not want and use. An example of this would be massage chairs in the back of a car that is hardly ever used but would increase the price of the car enormously. In order to avoid this waste, it is necessary to **put oneself in the perspective of the buyers** and to think carefully about what they really need and what they are willing to spend money on.
	Not utilized talent An **eighth aspect** has emerged in recent years that can have a negative impact on the efficiency of a company. This relates to the potential of us humans as employees. If the **competencies of employees** are not used for the improvement of processes and activities, this is to be regarded as waste, because it is precisely these people who know best what could be improved in their workplaces. Therefore, it is all the more important to **involve the entire staff in the development of improvement strategies.**

To reduce or eliminate all these wastes, it is important to identify them as early as possible. To do this, it is useful to put yourself in the customers' position and consider which of the company's processes bring value to them. The remaining wasteful processes should be noted and measures to minimize them should be considered.

Co-funded by the Erasmus+ Programme of the European Union

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Indicator

Various methods can be used to **identify waste** within a company. One example is **Value Stream Mapping:** https://kanbanize.com/lean-management/value-waste/value-stream-mapping
Another possibility for identifying and eliminating waste is conducting the **Gemba Walk:** https://kanbanize.com/lean-management/improvement/gemba-walk

For the **successful elimination** of the various wastes, **anticipatory planning, a clear strategy , as well as intensive communication with the entire workforce,** are indispensable.

https://www.youtube.com/watch?v=bVCe9vs68Pk

https://www.youtube.com/watch?v=Txt_I5dKgtk

https://www.youtube.com/watch?v=VWN8NrJ7LE8

Practice

To ensure that your students get a better understanding of the 8 wastes of Lean and how they are connected to sustainability, you could include activity A12 in your teaching.

You can find the instructions as well as supporting documents of this activity A12 "Waste analysis" here: https://www.train2sustain.eu/instructors/

Co-funded by the Erasmus+ Programme of the European Union

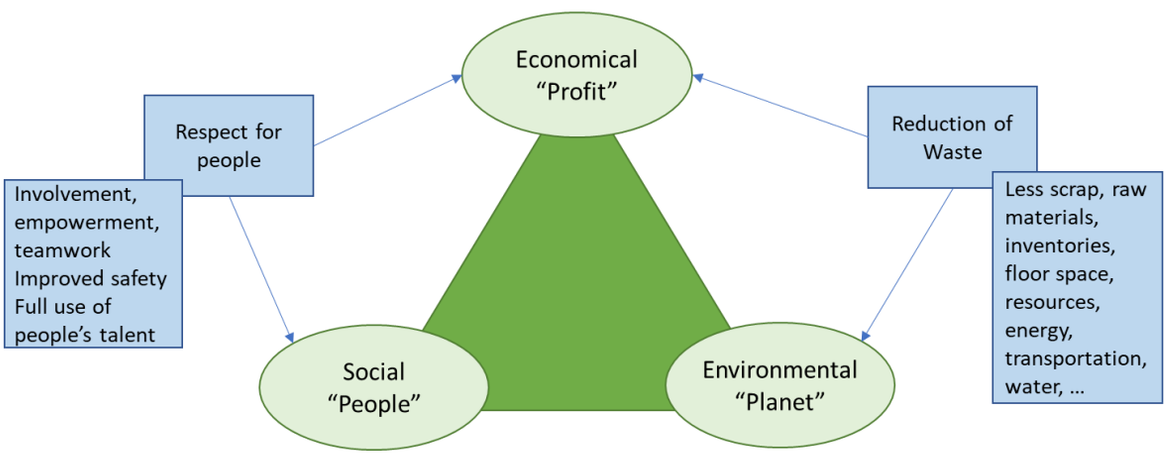
This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

5 How Lean can support Sustainability

Interaction

You have heard a lot about Lean Management and its characteristics. But how does Lean relate to sustainability, what do you think? Take a few minutes to think about it before you read on.

The following graphic gives you a rough overview of how Lean Management can positively influence sustainability:



Source: Adapted from Järvenpää, Eeva/Lanz, Minna (2019): Lean Manufacturing and Sustainable Development, p 7

Figure 6. Relation between Lean and Sustainability

As you can see in the graphic, Lean has an impact on all three dimensions of sustainability. For example, shorter transport routes, the reduction of waste or the efficient use of resources can contribute to protecting the environment or strengthening the economy. The increased involvement of employees in turn has a positive influence on the social aspect. In the following, you will gain a more comprehensive insight into these interrelationships. We show you:

- how considering the 5 Lean principles affects sustainability.
- how the 5S influence the sustainability aspect.
- how eliminating the 8 types of waste contributes to sustainability.

5 Lean Principles and Sustainability

- In Lean Management, only those processes that create value are carried out. Everything that does not bring value is seen as waste and should be avoided. On the one hand, this leads to avoiding waste, saving time and energy, and not overusing the manpower of the staff. On the other hand, it brings economic advantages.
- Since only what is really needed is produced, raw materials are conserved. This also means that the company is less dependent on raw material stocks, which contributes to

Co-funded by the Erasmus+ Programme of the European Union

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

increased economic efficiency. In addition, waste can be reduced because nothing has to be thrown away.
- Continuous improvement also effects sustainability, as constant attention is paid to how waste can be identified and eliminated.
- In Lean Management, machines are always preventively maintained, which means that they are usable for the company for a longer time and require less energy.
- In Lean, people always play an important role. Through the implementation of this management system, people are shown respect and appreciation and are involved in the further development of the company.

5s and Sustainability

Let's remember the 5S again: Sort, Set in order, Shine, Standardise, Self-discipline. How can these activities contribute to a more sustainable way of working?

- By sorting and organising work equipment, you get an overview of which items are really needed and which are already available. This leads to fewer purchases of materials and thus conserves resources. In addition, the work can be done faster, which has an impact on the economic aspect of sustainability.
- If the workplace is kept clean, energy can be saved. For example, if the windows are cleaned regularly, more daylight can enter the room and less or no additional electric light is needed. In addition, the well-being and satisfaction of the employees is increased.
- People have a better overview of the workplace. Thus, it would easily be noticed if there was a leak somewhere, something was spilling or energy was being wasted unnecessarily.

8 Wastes and Sustainability

You have already learned in this content unit that the goal of Lean Management is to minimise or eliminate all possible waste. This does not only have an effect on the efficiency within a company, but it can also positively influence the sustainability of an organisation. Here you can find a few examples:

- Inventory: By keeping stocks as small as possible, energy can be saved, for example, due to smaller warehouses. In addition, the risk of stored items breaking down or deteriorating is lower.
- Waiting: Heating, electricity, staff etc. are also needed during waiting times. If waiting times are reduced, costs can be saved and negative impacts on the environment can be avoided.
- Defects: Working with a higher quality level results in fewer defects and longer product life. This means less waste is produced and resources are conserved.
- Overproduction: Producing only what is needed reduces waste, emissions, energy consumption, time, costs and the demands on staff.
- Motion: If a workplace is organised in such a way that as few movements as possible are necessary, this reduces the risk of accidents and injuries. Safety in the workplace is thus increased. In addition digitalisation decreases the need for movement of staff or customers that can save emission.
- Transportation: Transport activities increase the number of emissions and the risk of products breaking. Moreover, additional packaging and energy are needed for transport. In order to protect the environment, as little transports as possible should be carried out.
- Extra processing: If only as much work is done as really necessary, resource use, waste, energy consumption and emissions can in turn be reduced.

Co-funded by the Erasmus+ Programme of the European Union

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

- **Not utilized talent:** Eliminating the eighth type of waste, which relates to the **competencies of the staff**, also contributes to sustainability: Here the focus is on the social aspect of sustainability. By relying on the skills and creativity of employees and including their opinions in the improvement processes, the feeling of equality increases.

Sustainability is sometimes already seen as a new Lean principle. In order for companies to remain successful in the long term, they must carry out their activities sustainably. However, it should be noted that a company should not only focus on one area such as production but should rather **take into account all processes along the value chain and sustainable design**. You can find here some examples of companies that already operate a successful Lean & Green Management and have even won an award for it:

- Siemens: https://www.youtube.com/watch?v=vfWLr-RQ7zs
- Porsche Leipzig: https://www.youtube.com/watch?v=lSiqVNpM71M
- Welbilt: https://www.youtube.com/watch?v=17pRfpjQKBc
- Bosch Blaichach: https://www.youtube.com/watch?v=aOEaJ-fgcZM
- elobau: https://www.youtube.com/watch?v=iRGdMZUkK-I
- Hammerer Aluminium Industries: https://www.youtube.com/watch?v=AgI-y5vT3bY

Important

Even if Lean Management contributes to sustainable development in certain respects, it must be emphasized that not all the elements of this management system are geared towards it.:

- In Lean, the customers and their needs always come first, above sustainability.
- Waste is not seen as those aspects that harm the environment, but rather as those activities that do not add value for the customer.
- Environmental and social sustainability are often associated with higher costs, whereas Lean is designed to reduce costs.

But even if some aspects are contradictory, **efficient Lean Management of a company can contribute very strongly to sustainable development**.

Digression

If you want to know more details about Lean Management, you can have a look at the website of the Erasmus+ project "Lean for work and Lean for life":
http://www.leanforworkandleanforlife.eu/

Practice

As your students have a lot of important information about Lean now, rounds 2 and 3 of the Pen Game (A11) can be played.

You can find the instructions as well as supporting documents of this activity A11 “Pen Game” here: https://www.train2sustain.eu/instructors/

Co-funded by the Erasmus+ Programme of the European Union

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

6 Summary

Safe knowledge

Lean management is a management system whose origins can be traced back to the Toyota Production System and which focuses on making all processes within a company as efficient as possible. The Lean approach aims to ensure that products/services are produced as quickly and cost-efficiently as possible and with the highest possible quality. The focus is on the customers - all processes that do not increase the value for the customers are seen as waste and eliminated as best as possible. Lean management can be applied in a wide range of industries and business sectors.

Basically, Lean Management works according to five principles: One of the most important aspects is to find out which products and activities have value for customers and which do not. Then it is important to get this value to the customers along the entire value chain and to minimize waste in the process. In doing so, attention should be paid to a continuous flow and only producing what is actually in demand. In addition, continuous improvement and striving for perfection are characteristics of this approach.

Lean Management is realized by integrating the 5S method into the company culture. In order to work as efficiently as possible, it is necessary to remove all unneeded items from a work area (sort), arrange the rest in the way that makes the most sense (set in order) and cleans the workplace (shine). These activities should be standardized for all work areas in order to simplify the employees' work (standardize). In connection with this, the motivation and commitment of the workforce (self-discipline) is also an important aspect. If these 5S are implemented, the efficiency as well as the quality of the products increase and the staff is more satisfied. In addition, working time can be saved and safety increased. For this method to be successful, however, the management level must clearly stand behind it and communicate transparent measures to the workforce, as well as fulfill the prerequisites for it.

Lean Management is characterized by eliminating waste as much as possible. These types of waste include high inventory levels, long waiting times, defects, many movements or transports, overproduction, extra processing and not involving the skills of employees. If all these points are identified and eliminated, this has a positive effect on the efficiency of a company.

However, Lean not only improves the processes in an organization, but it also has an impact on the sustainability aspect. Many activities carried out within the framework of Lean Management help to protect the environment, increase profitability and increase the employee satisfaction.

Co-funded by the Erasmus+ Programme of the European Union

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

7 Resources

Introduction:

https://lean-managementmethode.de/lean-management-methode/

Lean Principles

https://ifm-business.de/aktuelles/business-news/was-ist-lean-management-definition-methoden.html

https://www.leanoffice.tv/lean-office/was-ist-lean/ursprung-toyota-produktionssystem/

https://kanbanize.com/lean-management/what-is-lean-management

https://www.iph-hannover.de/de/information/lean-production/methoden-lean-management/#:~:text=Anwendungsfelder%20der%20Lean%20Management%20Methoden,-Lean%20Management%20Methoden&text=Unternehmensbereiche%20zur%20Verwendung%20der%20Lean,der%20sauberen%20und%20geordneten%20Arbeitspl%C3%A4tze.

5S

https://www.bxb-management.de/5s-methode/#:~:text=5s%20Methode%20ist%20urspr%C3%BCnglich%20entstanden,in%20der%20Verwaltung%20erfolgreich%20genutzt.

https://lean-managementmethode.de/lean_methoden_werkzeuge/5s_methode/

https://refa.de/service/refa-lexikon/5s-methode#:~:text=Die%205S%2DMethode%20ist%20eine,(7%20Verschwendungsarten)%20zu%20minimieren.

https://www.epa.gov/sustainability/lean-thinking-and-methods-5s#:~:text=The%205S%20pillars%2C%20Sort%20(Seiri,sustaining%20a%20productive%20work%20environment.

8 wastes

https://theleanway.net/The-8-Wastes-of-Lean

https://refa.de/service/refa-lexikon/7-verschwendungsarten

https://kanbanize.com/lean-management/value-waste/7-wastes-of-lean

Lean und Sustainability

Järvenpää, Eeva/Lanz, Minna (2019): Lean Manufacturing and Sustainable Development, DOI: 10.1007/978-3-319-71062-4_7-1

Fliedner, Gene (2008): Sustainability: A new lean principle, URL: https://www.researchgate.net/publication/229040858_Sustainability_A_new_lean_principle

https://media.zweikern.com/de/index/lean-green-nachhaltiges-lean-management

https://www.epa.gov/sustainability/lean-environment-toolkit-chapter-2

Co-funded by the Erasmus+ Programme of the European Union

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.