Increased competition in the sewing industry requires demand and the introduction of innovations to improve efficiency and production quality without increasing costs. The paper discusses the principles of Lean Systems and their application in the sewing industry in Bulgaria. The value stream is mapped, according to the specifics of the production of sewing products - ready made garments and a new value stream model is presented in which pre-and post-production activities are optimized.

**Key words:** Lean Systems, sewing industry, value stream

**INTRODUCTION**

Lean Manufacturing, as known Lean Production, is created as production system by Toyota and due to this fact - known as the Toyota Production System (TPS). It was established in Japan between 1948 and 1975 by Taichi Ohno and Eiji Toyoda. They called it Just-in-time manufacturing [1].

The introduction of the system is aimed to eliminate inefficiencies in production operations and waste. These are all components in any production process that do not add value. The process is so successful that the Toyota Production System has long been beyond the boundaries of Toyota and Japan and has entered manufacturing sectors all over the world.

Lean’s core principles influence concepts not only in industry, but also in sectors such as healthcare, the IT sector, services, and so on. When the principles are implemented correctly, Lean can lead to major improvements in efficiency, production time, productivity, material costs, waste, which in turn leads to lower costs and increased competitiveness.

Lean Manufacturing has been successful on a range of sizes - from large corporations to small businesses, and even micro-companies. It improves teamwork, inventory management, quality, reduces operating costs, deadlines, improves customer interaction, and so on.

*The aim of the paper is to examine the principles of Lean systems and to analyse the possibilities for their application in sewing companies, producing in Bulgaria, taking into consideration the specifics of production.*

**EXPOSITION**

Each production is accompanied by its peculiarities. Introducing significant improvements is a laborious process. By using Lean Manufacturing’s capabilities to know basic principles and implement different tools to deliver Lean Manufacturing enables production to become an effective, well-functioning system.

By its creating Toyota Production System (TPS) is trying to prevent:

1. *Muda* - Japanese term for “waste”. Muda is all in the production process that creates waste or
limitations for creating a valuable product. These are all activities in the production that do not add any value.

TPS defines 8 types of waste (DOWNTIME):

- **Defects** - errors that require additional time, resources and remedies.
- **Over-production** - at the output of the process, the basic product is not available, and at the same time the workers are committed to produce products that are not so urgent at the moment.
- **Waiting** - the job must be stopped for some reason, the worker is overloaded and fails to pass on the required amount, or waiting for approval, or because the available materials are exhausted, etc.
- **Not using talent** - insufficient use of talents, skills, knowledge, inventiveness of people.
- **Transportation** - unnecessary transport, resulting in increased costs, waste of time and increased likelihood of damage and deterioration of product quality.
- **Inventory excess** - there is production and supply that is above actual customer demand.
- **Motion waste** - people, equipment or machines that do not add value to the product, service or process.
- **Excess processing** - it takes longer than necessary to process the product.

2. **Mura** - Japanese term for “irregularities in operations”. Mura is all that creates ineffective workflows and disturbs consistency. An example of Mura is if less than the planned number of items are produced for the day, and the next day more than necessary.

3. **Muri** - the Japanese term for “overloading of people and equipment”. These are all tasks or tasks that cause too much pressure on employees or machines. If an operator is burdened with too much work, this leads to his exhaustion and reduced efficiency of his actions, rather than part of it being delegated to someone else. When operating a machine that has been in the service for a longer period of time than is foreseen in its standard features, damage is possible.

When introducing TPS, it is intended to minimize or eliminate Muda, Mura and Muri.

In [2] the TPS management philosophy is analyzed and refined. The main principles of the Lean concept and its implementation in the organization are defined as a process consisting of the following five stages:

1. **Value** - Determine what value is added to the customer.
2. **Value stream** - Clarify which activities in the process create added value for the client and which does not.
3. **Flow** - Maintain smooth flow of the process all the time and eliminate losses that can cause delays.
4. **Pull (Production Withdrawal)** - Avoidance of production greater than demand.
5. **Perfection** - Continuous striving for improvement.

For the successful implementation of the system it is necessary to develop a strategy, which includes an analysis of each of the principles from the point of view of the particular production.

The value is created by the manufacturer but is always determined by the customer’s needs for the particular product. It is important to identify customers and determine the added value that products or services bring. The company must strive to eliminate the waste and the cost of its business processes so that the optimum price of the customer is achieved at the highest profit for the company.

The client is not willing to pay for resources and time that is not invested in the specific product. In other words, companies need to understand the value the client add to the products and services, which in turn can help them determine how much money the client is willing to pay. This helps to clearly see which units and operations generate “added value” for the client. This ensures a reduction in production costs, identifying the teams that usually carry out the essential part of the work, as well as the unnecessary units that can be removed. As a result, the final item price is approaching the value in terms of the client that he is willing to pay.

For example, when making sewing products, the client is willing to pay a price that includes the cost of materials delivery and manufacture of the product, within the desired timeframe. If the enterprise uses intermediates for delivery, this increases the final price. From the client’s point of view, these units and activities do not bring him added value and he is not willing to pay for them.

Value stream - Defining and outlining the path of creating value added for the client. Once the value is determined, the next step is mapping the “value stream”. This includes a description of all processes,
teams and accompanying activities involved in the stages of creating value added in products or services, all steps and operations from the delivery of raw materials for processing to delivery of the ready-made garment (RMG) to the client. This principle includes recording and analyzing the flow of information or materials needed to produce a particular product or service for the purpose of identifying waste and methods of improvement. Value stream covers the entire life cycle of the product. Mapping is a simple but effective way that identifies all actions that are put into the product or service at each stage. This process can be the design of the production process, the supply of materials, human resources employed in production, administration, customer service.

The idea is to make a short and clear “flow map” for the whole process. The goal is to identify all steps that do not create value and then find ways to remove or reduce them. Sometimes this principle is called re-engineering of the process. Ultimately, its application leads to a better understanding of the entire business operation. This is the ultimate end-to-end process that creates added value for the client.

After the first step - understanding the needs and desires of clients, the second is an analysis of how to be satisfied [3].

The value stream of a RMG, produced in a Bulgarian company, which is working on CMT-Cut, Make and Trim process, has the following form (Figure 1). In the mapped flow, the client is the part of the flow, who makes the orders for the RMG production.

New flow - create a new process by eliminating the unnecessary components. Removing functional barriers and identify ways to improve runtime to ensure that processes run smoothly from the time the order is received to delivery. The steps to create value are done in a strict sequence so that the product or service moves smoothly to the customer. The flow is critical to the removal of waste. Lean production depends on preventing interruptions in the production process and creating a harmonized and integrated set of processes where the activities move in a steady stream.

From the created value stream map of the sewing product, it is found that there are units and activities that do not have value for the client. Such are the intermediaries of materials delivery and logistics of finished products to the end buyer and they can be removed.

For the same sewing product, a new value stream has been developed (Figure 2).

It does not have intermediaries. Deliveries are requested through an electronic system, directly from a manufacturer. The cost of remuneration of intermediaries and the time from request to delivery are reduced.

Once the waste is removed from the flow of the value, the next step is to ensure that the remaining steps run smoothly, i.e. the way clients receive their added value is direct - without interruptions, delays or losses. This is perhaps the biggest challenge to create cross-links in all departments to ensure flow of the process.

**Pull is the fourth principle of Lean production.** Respond to market demand by creating a pull system. Identify when and why clients are looking for products and services, and the process follows client needs whenever and wherever the client wants. This means starting a new job only when there is a search for it so that the products are made on a “just in time” basis, the materials are not stored and clients receive their...
orders for weeks rather than months.

With improved flow, time to market (or time
to client) can be significantly shortened. The client
can download the product from the manufacturer if
necessary.

As a result, it is not necessary for the sewing
company to pre-manufacture the products or to store
materials for them, thus saving money for both the
manufacturer / supplier and the client. Another major
risk of dropping out of the fashion for the garment
is avoided, resulting in substantial losses for all
participants in the chain.

Lean manufacturing uses a pull system where
nothing is bought or produced in advance until a
search occurs. The pull relies on flexibility and good
communication.

Perfection is the fifth principle of Lean production.
Once “surpluses” have been identified, they have to be
accepted not as a philosophy of processes but as “work
philosophy”, strategy and vision. Which means Lean
thinking and process improvement should become a
core part of corporate culture.

The implementation of steps 1-4 is an important
beginning, but the fifth step is probably the most
important: turning Lean thinking and improving the
process into corporate culture. For a good end result,
constant effort and vigilance and improvement are
required. Every employee should be involved in the
implementation of the Lean system.

Perfection is accompanied by continuous
improvement of the process. A radical reorganization
in the company, following the way the client receives
the product, would help to see more surpluses.

The implementation of Lean strategy guarantees
not a high but imperative high quality of products and
services. Achieving the desired results is not just a
matter for managers, employees also have an active
role in turning Lean companies into the lead.

In order to make the Lean production system more
concrete and less abstract, it is important to know the
tools for its implementation. From their proper use,
depending on the specifics of production, depends on
their efficiency.

CONCLUSION

Lean is not a static system and does not
work equally for all companies. For its effective
implementation, it is essential to take into account the
specificities of production and of the company itself.
The presented examples of the application of the basic
principles have taken into account the fact that in
Bulgaria the sewing industry works mainly of a CMT.
Requests are made by a client, and the company itself
has no great opportunities to change the technology
of making products. In mapping the value stream, it
has been found that stream optimization could be
done by removing units and activities before and after
production.

Reducing the value of the products could be
achieved by strictly controlling the execution schedule,
selecting resources and materials, selecting effective
communications channels, both with the client and
with the rest of the chain production and delivery.

Through the right tools and system implementation,
seams can be produced with the highest quality, while
increasing the revenue and productivity of the sewing
company.

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