DESIGN OF A LEARNING PLATFORM FOR 5S METHOD FOR USING TO IMPROVE A MANUFACTURING SYSTEM

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Abstract: For industry and science, the lean concept is a promising opportunity to realize a continuous quality while enhancing the effectiveness. Some industries, like the automobile industry, already reached a high lean status. The focus is on the methods of standardization and identification of problems, as 5S method. More the workplace is clean and organized, faster the problems are identified, because a clean working environment, is more predictive and a safer place. Starting from the principles of 5S method, the main objective of this paper is to develop a learning platform for this method, with the purpose to help increase the competences in Lean Manufacturing. The accuracy and usefulness of this platform is checked by using it in the improvement of a production system.

Keywords: 5S, factory learning, improvement, production

1. INTRODUCTION

Baena, 2017 tell us that the Learning Factory appear for the first time in an initiative of a group of universities from the United States in 1995 and since then was an official initiative for the education of engineers. Learning platforms constitute an indispensable tool for the deployment of online training courses. Not only do they provide significant benefits that have an impact on numerous areas of a company's presence, but they also showcase functional features which can take online training to the next level.

According to Veza, 2015, Lean Learning Factory appeared the first time in 2009 in the Faculty of Electric Engineering, Mechanical Engineering and Naval architecture, laboratory of industrial engineering of Split, Croatia. Its mission is to help bring the real-word into the classroom by giving practical experience for engineering students, to help transfer scientific research to industry through collaborative projects.

Lean Learning Factory was developed, firstly, to shorten the duration of

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implementation of this concept in an enterprise (usually the implementation of Lean Manufacturing concept in an enterprise is at least of 6 months). The second scope of this learning platform is to allow the teaching of Lean methods and tools, so the employees can apply them easily at their workplace.

Starting from this concept, in the laboratory of the University of Pitesti, a learning platform for the Lean Manufacturing concept is built. Part of this laboratory is the 5S platform that is developed and designed to ease the learning of this method.

2. 5S METHODOLOGY

5S Method was developed at the begging of the '80s by Hiroyuki Hirano in Japan and was first heard of as one of the techniques that enabled what was then termed "Just in Time Manufacturing".

An efficient and high quality work needs a clean environment, safety and rigor. The 5S principle, Seiri, Seiton, Seiso, Seiketsu, Shitsuke, allows the creation of a functional working environment, with simple, precise and efficient rules. The 5S is the foundation on which is it build the progress of Lean Manufacturing means and methods, acting as a stirring point in the management of change. In the same time, the 5S can be considered as basic rules of order, discipline, the starting kit for an improvement project.

Starting from the statement "the loss is a potential gain", any liberation of loss means a gain. Important to notice is that no real improvement of productivity and quality will persist in the presence of waste. Concluding, we can state that 5S represents a generic term, "a mnemonic mean to see principle of spirit". The 5S represents the first 5 letters of Japanese origin. In table 1, are shown translations of these in French, literary and usual, English and Romanian.

Table 1. **5S structure**

Japanese	**French**		**English**	**Romanian**
	Literary	**Usual**		
Seiri	ranger	s'organiser	sorting out	a rândui
Seiton	ordre, arrangement	situer(les choses)	systematic, arrangement	ordine
Seiso	nettoyage	scintiller	spic and span	curat
Seiketsu	propre, net	standardiser	standardizing	standard
Shitsuke	education	suivi	self-discipline	urmărire

The first S – Sort focuses on eliminating unnecessary items in the workplace. Focuses on eliminating unnecessary items from the workplace. Categorize equipment, furniture, tool in your working place into the following 3 categories:

- Necessary
- Unnecessary
- May not necessary

This step will also help with the "just in case" attitude.

All the unnecessary objects will have a red label and these will be recycled or stored in a special area of the warehouse.

The second S – Set in order implies to arrange and reduce the useless search. The principle of this set of actions can be resumed as:

- To arrange the useful object in a functional manner
- To replace in the designated area the used tools
- To make accessories and supports, that allow a fast identification
- To define rules of arrangement

This last step means also to:

- Paint the surfaces so the dirt can be seen
- To visually mark the limits of work areas
- To highlight the tools positions on panoplies etc.

The third S - Scrub, Sweep, Straighten implies to clean, the workspace will be freed of all the dirt, dust, unwanted scrap, creating a healthy environment, safer for humans and machines. In this step are targeted mostly:

- Storage areas – warehouse, shelves, tools and equipment storage
- Equipment: machines, logistic equipment, elevators etc.
- Surroundings: corridors, windows, conference rooms, wardrobes, cabinets etc.

During the cleaning a series of observations must be made: broken parts, and measuring tools, loose nuts and bolts cracked housings, lubricant levels.

The forth S –Standardize - includes activities which establish a regular and continuous practice of maintaining tidiness, orderliness, and cleanliness. Make rules and procedures to promote a good work environment until the first three S become everybody second nature. Thus, the following kinds of: development of Standard Operational Procedures, display marking of safety signs, garbage segregation system following the infection prevention and control, waste management policy, color cording for linen system, zoning for storing/parking equipment.

The fifth S – Sustain – includes activities of revision of standards. It must be put in place a survey system, for the 5S, making sure that it will be continued. Periodically the limits of workstations and other specifications are revised in a process of continuum improvement, a Kaizen.

Shitsuke or the following, assumes also the involvement, meaning the auto evaluation, to promote a team spirit, to impose rules of behavior, to put in place a good communication, to valorize the obtained results etc. All must step is a big win. After a first successful implementation, it can be continued the process of sorting, amelioration of ranging (cleaning process) and other places not considered before.

3. DESIGN THE 5S PLATFORM

In order for the 5S method to be successful, the most important factor is the commitment, participation and involvement of everyone and strong visible support from top management. To ensure the success of implementation is needed that the all

the employees of the enterprise know the 5S practices. Generally, 5S method can be performed with the help of specialists which obligated the employees to execute the improvements with 5S. The resistance to change of the employees is most of the time caused but the lack of knowledge related to work improvement concepts. To easier spread the 5S methodology, in the Lean Learning Factory, it was build a learning platform Step-by-Step Implementation 5S, which encourages workers to become active in the implementation of this method. This platform which is the starting point of 5S: Step-by-Step Implementation, encourages workers to become actively involved in the application exercises.

To build the 5S platform were used aluminum profile Lean Cube. The Lean Cube it is made as the model of Lean CUBE on site www.Leanproducts.eu. The aluminum profile Lean 5S CUBE is a display system combine display boards with the concept of LEAN displays offering a compact solution for teaching, information display, and visual management and have the next specifications:

- writable with every type of marker
- magnetic surface
- erasable surface
- base on wheels
- Structure is 650x650x2000 mm, see Fig. 1

Fig. 1. Aluminum Lean Platform

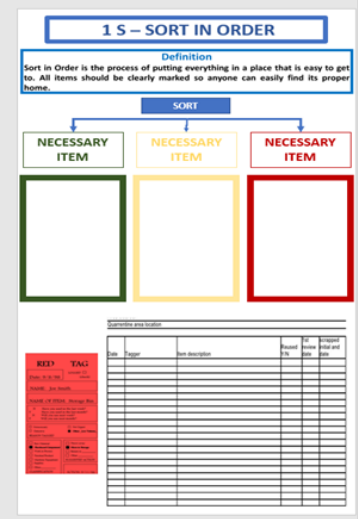


Fig. 2. The 1S platform

The first facet of the cube is dedicated to learning the principles of the first S. This contains:

- The definition of first S
- The red list – all the unused objects
- The yellow list – all the objects that could be useful or we are not sure we will could find them any use

- The green list – all the objects that are in use
- The red labels – that will be placed on all the objects from the red list
- The register for red labels – in which are registered all that is happening with the labeled objects (to be recycled/ stored in another area etc.), see fig.2.

To the second S is presented on the second facet of the Lean Cube. This side teaches us how to use the 5S tools to help for the cleaning:

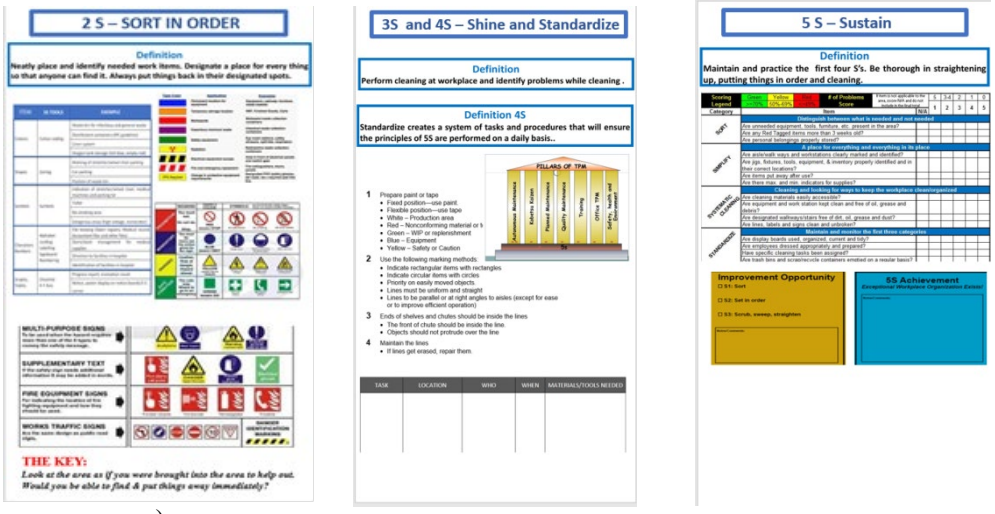
- The definition of the second S
- How to range the objects based on "Can see, Can take-out, Can return" Philosophy
- 5S color coding
- How to label the objects so we can easily identify them
- How to mark the areas of work, see fig, 3a.

The next facet of the Lean "cube" teaches us how to clean, how to identify what are the causes of apparition of dirt and how can we standardize. This contains:

- The definition for 3S and 4S
- Cleaning activities methodology
- Total equipment management
- The standardization methodology, see fig. 3b

The last facet of the "cube" helps to learn how to make a 5S audit and how to maintain all that we obtained on the first 4S, therefore it contains:

- The definition of the 5ft S;
- 5S audit check list;
- 5S audit summary sheet;
- Improvement Opportunity cards and blue 5S Achievement cards, see Fig.3c.



a) b) c)

Fig. 3. 5S Platform

4. CONCLUSIONS

This paper presents a holistic approach to competence developments of 5s in learning factory. Among primary activities the principles of the 5S method can also be found in support activities of a company and have established the approach of Lean method. 5S Platform represents an outstanding possibility to implement active learning methods and to improve learning environments. With the help of this we can increase the classes of competences which are necessary for future employees in the industry.

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