

THE WORKSHOP OF PROCESS IMPROVEMENT AS A LEAN CONCEPT TOOL

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Abstract

The aim of the article is to present a different look on opportunities for improvement in the production process. Lean as a concept is evolving and searching for new effective ways to reduce losses and waste. Introduction of lean management into research and development processes might be a way to overcome those restrictions. Prototyping of products and development of new devices and machines to perform the process are often completely separate tasks, whereas designing machines and devices embodying precisely defined functions is a way of speeding up the production, avoiding losses and improving efficiency, even by increasing savings on equipment, improving the quality of our products and other methods. This article presents one of the tools of the lean concept, the moonshine workshop.

Keywords: Moonshine workshop, lean management

1. INTRODUCTION

Lean approach to production processes involves reducing the number of processes that add no value to the product and errors in the production process, which directly translates into lower business costs and increased efficiency [1]. The basic premise of the Lean concept is to eliminate any waste in the production process (muda), which is understood as any activity in which resources are consumed and do not contribute to the creation of value. The problem of losses in the production process arises frequently during the design stage of a product or process and sometimes also relates to improper selection of machines and apparatus for carrying out manufacturing operations. Therefore, the development process which takes into account the use of lean concepts to improve processes and products, requires implementation of methods and tools specific for this orientation, that have to be used already in the design phase of the products and the production stations. The article presents the workshop process improvement as a solution operating within lean concepts, which plays an important role in places where you need a quick and radical change. Moonshine workshops, which are described in the article, affect the proper design of equipment and the related impact on reducing losses and waste, because they pursue only the necessary functions of the process.

2. IMPORTANCE OF THE LEAN CONCEPT IN PRODUCT DEVELOPMENT

The Lean concept is used already during the design and implementation of new products. The research and development activities should ensure a relationship between technology and the manufacturing process of products. This approach enables customers to have a faster start-up of production following the implementation of a new product [2, 3]. IMVP program introduced in the US pointed to four main areas where it was found that Lean had an impact on the product development process, allowing for faster implementation and better quality of projects, commissioning of new production while less effort. Those areas were: leadership, teamwork, communication and concurrent engineering (see Table 1).

The traditional approach does not take into account the technology of manufacturing parts, which necessitates introduction of a number of changes after completion of the project and during normal execution of production. Introduction of the research and development issues related to the technology of manufacturing parts at the

very beginning of the process allows to avoid difficulties in the implementation phase to the production of parts and reduces potential wastage, which is consistent with the Lean concept.

Table 1 Comparison of product development processes [3, 4]

	Design with the Lean concept	Traditional design
Leadership	The project leader who is the real head of the project team.	The leader as an operations coordinator with limited authority over the project team members.
Teamwork	A project team consisting of employees from different departments delegated to the tasks related to the project for its duration.	Members of the project team are reassigned from their functional departments only for a short time as part of an ongoing project.
Communication	Clear and transparent communication at every stage of the project, in close collaboration between departments.	Solution of huge issues is postponed or delayed in time, there is a reluctance to confront problems and conflicts.
Design process	Concurrent design - concurrent steps involved in designing the various parts are launched in parallel, necessary modifications are communicated and implemented on an ongoing basis.	Design in stages - concurrent steps in designing parts are initiated only after completion of the previous phase (e.g. designing of molds begins only after the development of precise specifications).

The available literature [4, 5] emphasizes the fact that the deployment scheme of workstations directly affects the implementation of the internal transport routines responsible for the movement of work objects, workshop help, auxiliary materials and waste. Improper placement and organization of work stations increases the length of time and transport routes, and further disrupt the continuity of the production process. Elimination of this waste is possible by using design methods of production process based on the concept of Lean development. The method, which affects the changes in this process, is workshop process improvement called “moonshine workshop” [6]. Moonshine workshop is not focused on the continuous improvement (kaizen) typical for the lean approach, but rather on the introduction of radical changes (kaikaku) in the design and manufacturing processes (see Fig. 1).

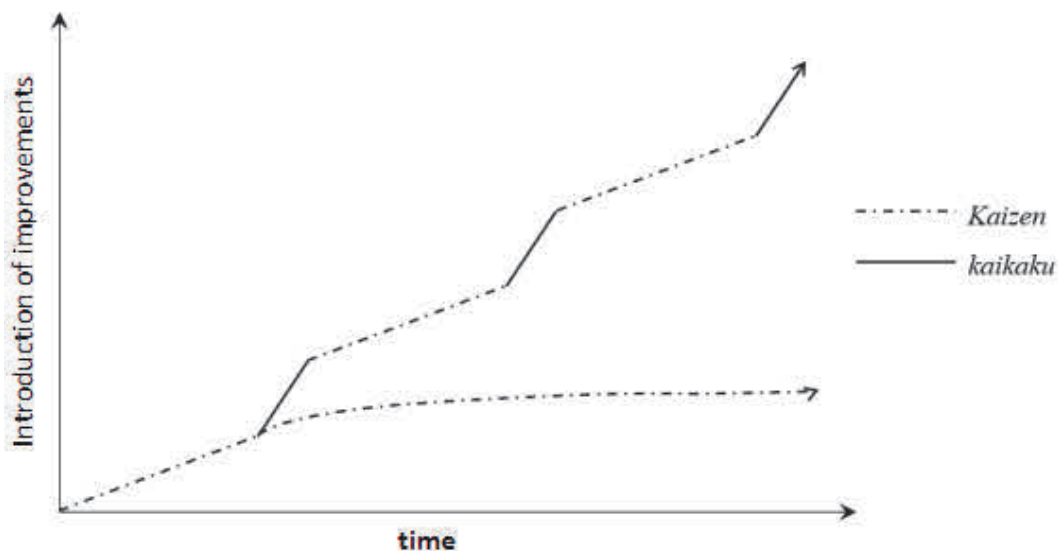


Fig 1 Kaizen vs. Kaikaku process improvement, based on [3, 6]

The process improvement workshop is primarily for designing devices to encourage the production process that are dedicated to solving specific problems - so called Right Sized Equipment (RSE). New methods of

manufacturing that often arise from the use of dedicated RSE very often necessitate modification of the structure and the reorganization of production, so called “process innovations” [6, 7].

3. MOONSHINE SHOP AS AN RSE PROJECT

Universal production machines available on the market often have additional functions that are essential in the specific production processes. Additionally, due to the versatility of devices, a concentration processes occurs around them. One of the main objectives of creating dedicated devices with an appropriate scale is to decentralize production and ensure that they are dedicated to manufacturing of specific parts. The correct definition of the requirements for such machines and their production capacity allows to create devices cheaper than universal units available on the market. Equipment properly designed to scale is characterized by, among others [6, 8, 9]:

- Fit to size manufacturing of parts made with it.
- Production capacity at the level required by the production plan.
- No need for calibration.
- A fixed work surface.
- Ergonomic arrangement of the controls work.
- Automatic issuance of the workpiece at the end of their operation (hanedashi).
- Placement of all power cables, pumps, etc. at the rear of the machine.
- Storage of all waste from the manufacturing process behind the device.

Application of these principles in the RSE design enables a smooth introduction of the production line. Such devices are the result of maintenance projects which are characterized by high innovation - moonshine workshops. The idea of this workshop refers to methods of 3P: Production, Preparation and Process [8, 9]. However, in 3P (Production, Preparation, Process) workshops, simulation concept is introduced after 7 ways have been developed and down-selected into two or three ideas. Moonshine develops these ideas into physical models that are then used for production simulations. During the simulations, the models are continually refined until evaluated and a superior design proposal emerge.

There is no precise definition of moonshine workshop. The tool originally referred to the illegal alcohol production during the Prohibition in the USA. The term was later coined by Shingijutsu [10], formerly part of Toyota, to describe this “exciting and innovative approach to creating something of value from spare and/or underutilized items”. The basic mindset is to create new processing machines that are specific to only basic elements of production (drill, cut, grind, etc.). Moonshine activities should be conducted in privacy and initial efforts should utilize only what can be recycled from old machines or easily and cheaply procured. Boeing uses several descriptions of moonshine, such as:

- A method of disruptive action that occurs in secrecy, under and around organizational boundaries and procedures, producing order-of-magnitude improvement to any process [11].
- A lean manufacturing tool that uses fast and inexpensive prototyping to develop and prove a concept prior to its full implementation [12].
- The lean manufacturing practice of dedicating non production time and space to freewheeling problem solving.
- Informal process development and improvement focusing on simple, reliable and safe solutions that promote lean manufacturing.

Moonshine is a Lean practice of employee-involved work related product and process innovation in which a solution is trystormed before formal implementation through retroengineering [6, 13].

The idea is to get people familiar with the product or process and use inexpensive material or anything they could find to make their own equipment. The production activity was done under the cover of night (or away

from other processes). The best ideas from those making the product were/are tried (simulated) and the best methods are adopted [9, 12].

The moonshine model is built up of eight stages that are essentially linear (see Figure 2). Linearity does not imply an algorithmic approach to solving a problem, i.e. no fixed path is available that guarantees a solution. Literature describes iterations, circular loops and return paths [11, 12, 13].

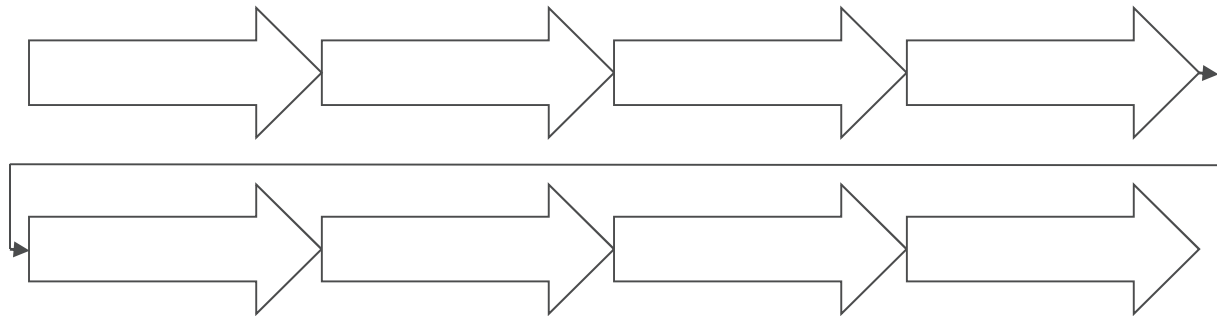


Fig. 2 shows a high level depiction of the moonshine process model [9, 11, 12]

The aims of each stage of the moonshine workshop are [9, 11]:

- Define and thoroughly analyze the problem, including an observation and analysis of the process in which the problem occurs.
- Identify the essential function of the product in order to get the simplest solution possible.
- Determine of the evaluation criteria that are used to judge the solutions after the brainstorm. The early placement in the process allows end users to elaborate on their own evaluation criteria.
- Get inspiration from everywhere including nature.
- Brainstorm stage in which team members are required to come up with solutions and to build on each other's ideas.
- Use of the evaluation criteria defined in stage 3 to select one or more solutions that will be trystormed.
- The trystorm stage is dedicated to building mock-ups and prototypes that are tested and improved until they satisfy the end user's needs.
- The formalization of the prototype with drawings and a strength and risk analysis to ensure a demonstrable safe use of a product before being put into service.

Creation of a production line consisting of devices to scale, designed for the production of specific details, eliminates losses in the manufacturing process, which are directly associated with producing parts for larger, universal machines. Such losses include, among others: time required for retooling, the need to produce parts in batches, and production of "parts for supply" [1, 7, 12].

4. CONCLUSION

One of the main ways to increase the efficiency of enterprises operating in the market economy is lowering their costs, particularly the cost of production. The concept of Lean development provides a set of methods and tools that allow for a systematic approach to improving manufacturing processes through the analysis and evaluation and eliminating those that do not create value. The use of Lean at the design stage of new products allows to prepare them better to be put into production. Projects carried out in this way are likely to end on schedule, are shorter and require fewer resources.

Process Improvement Workshop is treated as a place where prototypes are created. The workshop allows to create prototypes or even entire production lines dedicated to the production of specific parts and / or products. This approach ensures that the implemented equipment designs convey only the necessary functions in the

production process, and this affects the optimum size and position. Defining objectives for appropriately scaled equipment usually takes place during the project workshops where all aspects of the constructed RSE are thoroughly analyzed and the first prototypes of such devices are built.

To ensure high reliability of the production process and improve the monitoring and control of parameter changes in the functioning equipment, automation of the production is often sought. Note, however, that automated processes are already optimized and do not create losses. Otherwise, waste occurring in the manufacturing process may be built in during the automation, which could make its subsequent improvement significantly more problematic.

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