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MAIN TOOLS OF LEAN MANUFACTURING IN THE MANAGEMENT SYSTEM

Abstract. One of the management systems that can bring an enterprise to a new level of production organization is a system called "Lean Production". This article was prepared on the basis of a master's thesis on the organizational foundations of lean manufacturing.

Keywords. *losses, just in time, kanban system, kaizen system, innovation, optimization of production processes.*

The founder of lean manufacturing is Taiichi Ohno, who started working at Toyota Motor Corporation in 1943, integrating the best world experience. In the mid-1950s, he began to build a special production organization system called the Toyota Production System or Toyota Production System (TPS). The Toyota system became known in the Western interpretation as Lean production, Lean manufacturing, Lean. A significant contribution to the development of the theory of lean production was made by Shigeo Shingo, an associate and assistant of Taiichi Ohno, who created, among other things, the SMED method. The ideas of lean manufacturing were expressed by Henry Ford, but they were not accepted by business, as they were far ahead of their time. The world's largest companies successfully use Toyota's experience: Alcoa, Boeing, United Technologies (USA), Porsche (Germany), Tool Rand and many others. Masaaki Imai was the first to spread the philosophy of Kaizen

around the world. His first book *Kaizen: The Key to Japan's Competitive Success* was published in 1986 and has been translated into 20 languages.

Taiichi Ohno wrote that Toyota's production system stands on two pillars: the *jidoka* system and just-in-time. *Jidoka* means “pulling”, that is, the idea that the next production stage requests the necessary products from the previous one, and until this is done, nothing is produced. Subsequently, within the framework of the concept of lean manufacturing, many elements were identified, each of which represents a certain method, and some (for example, *kaizen*) themselves claim the status of a concept:

TPM (Total Productive Maintenance) system - Total equipment maintenance.

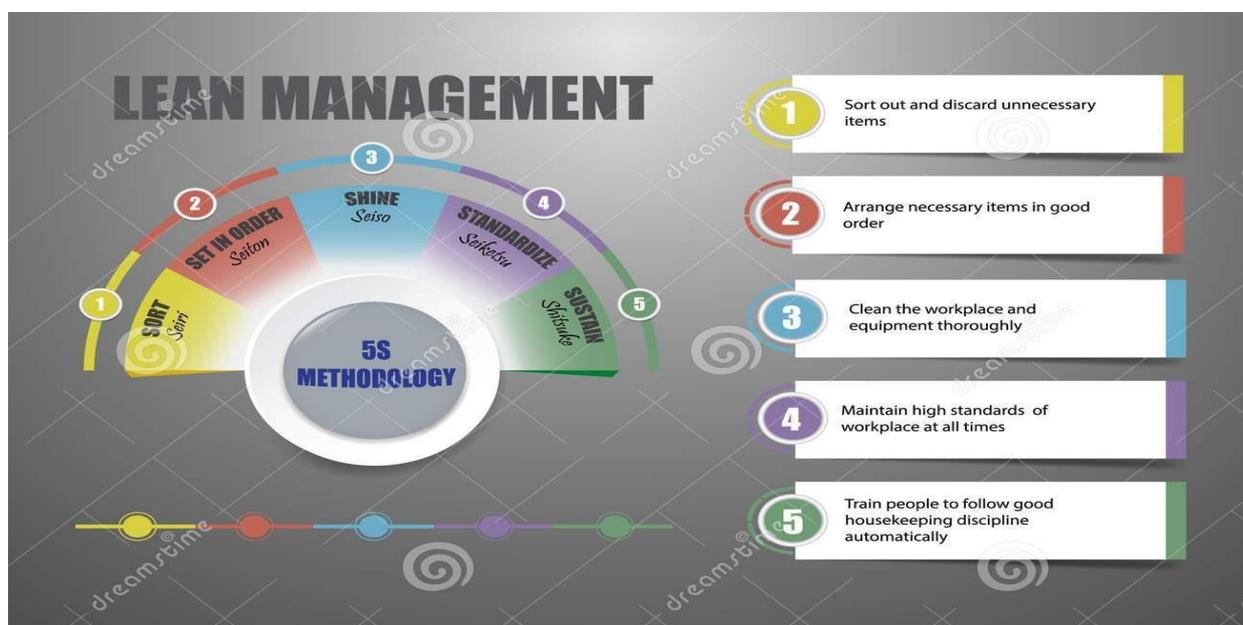
5S system (sort, tidy, keep clean, standardize, improve).

Single-Minute Exchange of Dies (SMED) - Single-Minute Exchange of Dies (literally "quick change of molds" - changeover / changeover of equipment in less than 10 minutes). One-touch setup - a variant of SMED, but changeover time is already measured units of minutes, that is, no more than 9).

Kaizen is continuous improvement.

Gemba kaizen is continuous improvement at the point of value creation.

Pull production, *kanban* - products are "pulled" by the customer, and not "pushed" by the manufacturer. Informing the previous production stage that work needs to be started;



Pic. 1. Lean manufacturing system

Just in Time - a system for synchronizing the transfer of product from one production stage to another using kanban cards. Components should be transferred to the next stage only when it is needed, and not a minute earlier.

Find an agent of change (you need a leader who can take responsibility);

Get the necessary knowledge of the Lean system (knowledge must be obtained from a reliable source);

Find or create a crisis (a good motive for introducing Lean is a crisis in the organization);

Map the entire value stream for each product family;

As soon as possible, start work in the main areas (information about the results should be available to the organization's staff);

Strive for immediate results;

Implement continuous improvement according to the Kaizen system (transition from value creation processes in the shops to administrative processes).

Efficiency. In general, the use of lean manufacturing principles can have significant effects. Prof. O. S. Vikhansky argues that the use of tools and methods of lean production can achieve a significant increase in the efficiency of the enterprise, labor productivity, improve the quality of products and increase competitiveness without significant capital investments. [3].

One of the largest platforms for the exchange of best practices in lean manufacturing is the Russian Lean Forums, which are held by the Orgprom Center. (Orgprom specialists use the term "lin".)

According to a study by the Institute for Comprehensive Strategic Studies (ICSI) on the spread of lean manufacturing in Russia in March-April 2011, out of 735 surveyed industrial CIS countries, 32% of enterprises used the Japanese experience. In March-April 2013, a second survey was conducted, the results of which were announced in the report

Lean map. The deployment of the concept of lean manufacturing in Russia is presented on the Lean-map, the world's first lean manufacturing map.[12] The Lean Map, created by ICSI and the Lean Blog, highlights businesses that reportedly use lean tools, as well as lean people — that is, people who are famous, have significant experience in lean manufacturing, and are active in spreading lean ideas. The map is constantly updated, including thanks to applications and user information. By request, you can mark on the map any organization using lean methods, and any person who has anything to do with lean manufacturing.

Lean mail. In the Danish Post Office, within the framework of Lean Manufacturing, a large-scale standardization of all offered services was carried out to increase labor productivity and speed up mail forwarding. For the identification and control of postal services, "maps for the in-line creation of their value" have been introduced. An effective motivation system for postal employees has been developed and implemented.

Lean Logistics (Ling Logistics). The synthesis of logistics and the Lean concept made it possible to create a pull system that unites all firms and enterprises involved in the value stream, in which there is a partial replenishment of inventories in small batches.[14] Lean Logistics uses the Total Logistics Cost (TLC) principle.

Lean office. Lean manufacturing methods are increasingly being used not only in manufacturing, but also in offices (lean office), as well as in local and central government bodies.

Lean home. The use of lean technology in everyday life makes it possible to make life environmentally friendly, to reduce energy costs to a minimum level. A passive house is a typical example of a lean lifestyle. A passive house, or rather an energy efficient house, is a house in which heating costs are about 10% of normal energy consumption, which practically makes it energy independent. The heat losses of the Passive House are less than 15 kW. hour/sq.m per year (for comparison, in an old-built house 300 kWh/sq.m per year), and the need for a slight heating of the house arises only at negative outdoor temperatures. Passive house at a frost of minus 20 cools down by 1 degree per day.

Lean construction is a Lean management strategy in the construction industry, aimed at improving the efficiency of all stages of construction.

Lean software development – adaptation of principles for software development.

One of the main channels for the dissemination of progressive ideas of lean manufacturing are specialized courses and programs on lean manufacturing and production systems in universities. The first (opened in 2005) and, unfortunately, so far the only specialized program in Russia for training specialists in the field of production systems and lean production is the MBA-Production Systems course at Moscow State University (at the faculty of the Higher School of Business).

To popularize the ideas of lean manufacturing in Russia, it is very important to attract the attention of talented and enterprising young people to this technology - students and young professionals. For these purposes, ICSI together with the Deming Association held the First in Russia competition of diploma and term papers on lean production.

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