European Proceedings of
Social and Behavioural Sciences
EpSBS

www.europeanproceedings.com
e-ISSN: 2357-1330

DOI: 10.15405/epsbs.2021.09.02.18

ICEST 2021
II International Conference on Economic and Social Trends for Sustainability of Modern Society

IMPROVING EFFICIENCY OF RUSSIAN ENTERPRISES THROUGH THE CONCEPT OF LEAN MANUFACTURING

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Abstract

Aiming to improve market positions and increase production efficiency in Russian companies often encounter such obstacles as insufficient management level, depreciation of fixed assets, etc. In these conditions the concept of lean manufacturing offers proven approaches, the main idea of which is to reduce costs associated with the irrational use of time, material resources, etc. To reduce time losses, the production process should be organized so that it is as much like a continuous conveyor belt. The lean manufacturing system plays a significant role in the National Project "Labor Productivity and Employment Support", which has been implemented since autumn 2018. The success of lean manufacturing depends on the level of corporate culture and the ability of the team to self-organize. A prerequisite for the growth of production efficiency is a high dedication of personnel on the one hand, as well as a sufficient level of material and non-material incentives on the other hand. The concept of lean production as a unified system is intended for the flow-line form of production. In this case, "pull production» and «just-in-time» system is implemented. In the workshop and group form, separate elements of lean manufacturing can be used.

Keywords: Lean manufacturing, quality, productivity, pull production, modernization

https://doi.org/ 10.15405/epsbs.2021.09.02.18
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eISSN: 2357-1330

1. Introduction

Addressing the challenges of increasing competitiveness, improving economic performance and increasing production volumes at many Russian enterprises faces a number of obstacles:

- inertness to managerial innovations introduction (Davydova & Yakovleva, 2011);
- mistakes when working with partners and suppliers;
- high depreciation of fixed assets;
- irrational use of fixed assets;
- uneven time loading of production capacities;
- focus on fixing defects rather than preventing defects.

To solve these problems the lean manufacturing system (LMS) (Olsen, 2015) can be applied, which is probably the most popular approach to improving performance indicators in Russia. This system has proven its efficiency in Japan, however, when using LMS, it is necessary to take into account national characteristics (Helper & Kleiner, 2007). It is also noted (Adrian et al., 2017) that the economical use of resources, which is characteristic of LMS, helps to minimize the technogenic impact on the environment.

The solution to the problem of building efficient production becomes more achievable if the principles of lean production, including minimization of losses, begin to be implemented already at the design stage of a new industrial facility, and simulation modeling can provide assistance herein (Smelov et al., 2014; Studnev & Burmistrov, 2019). As indicated, it allows evaluating various options for organizing production in advance.

2. Problem Statement

LMS has great potential, however, the efficiency of the system introduction at a particular enterprise varies widely (Helper & Kleiner, 2007); it depends on a number of factors, which manifest themselves in different ways depending on the country and region. The question of these factors systematization and their study is relevant.

3. Research Questions

In the context of introduction and subsequent use of LMS, the most significant are the following issues:

- the influence of the production type on LMS efficiency;
- LMS introduction in the conditions of "pull" and "push" production
- a degree of "personnel involvement", as well as the level of an enterprise self-management;
- availability of LMS standards and their content in Russia;
- the nature of the tasks solved within the framework of the National Project "Labor productivity and employment support";

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- the results of the National Project "Labor productivity and employment support" implementation and their analysis.

4. Purpose of the Study

The purpose of the study was to research the influence of the production type, as well as the methods of personnel motivation and the level of company self-management on the LMS efficiency, as a part of the National Project, in particular.

5. Research Methods

The research used methods of literary sources evaluation, analysis, generalization and systematization.

6. Findings

6.1. Pulling production

It is known that one of the types of losses according to the concept of lean manufacturing is "delays", i.e. periods of time when the manufacturing process does not carry out the operations of processing, assembly, inspection, etc., thereby increasing the time "from unloading to delivery". The author of the article (Shibanov, 2019) made a detailed analysis of this approach. This scientific work indicates that in some industries delays in the technological process are quite acceptable, and the work pieces are at the same time “on specially designated buffer areas” (Shibanov, 2019) It is easy to understand that here we come into conflict with one of the principles of lean production, namely, with the desire to reduce all types of losses. Probably, the presence of the work piece on the buffer site is justified only by the peculiarities of production, for example, it can be the time of drying, cooling, etc. the time of a certain slow physical process, which has not yet been intensified for reasons of technical or economic nature. The same scientific work indicates that exact observance of the technological process continuity, which is a condition for saving time, will in fact lead to downtime of a part of the equipment. Indeed, different technological installations and machine tools have different productivity. If we follow the principle of “pull” production, then the equipment involved in the longest technological operation will work 100% of the time, and more productive equipment will not be used after its function has been completed. In general, pull production and the "just in time" system show the best results on conveyor lines (Lapshina, 2019), which are initially organized according to the principle of minimizing delays between individual technological operations. As you know, an approximate balance of productivity in different technological operations can be achieved only in the case of flow-line form of production. Accordingly, in an effort to reduce time losses, the production process should be organized so that it is as similar to a continuous conveyor as possible.

The author (Shibanov, 2019) points out that “push” production is often practiced not because of outdated, inflexible management. The real reason is that there is a need to create reserves at "bottlenecks" where equipment failure, interruptions in the supply of raw materials, and unstable quality are possible. In such cases, minimization of decoupling stock becomes possible only when a stable level of quality and

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productivity is achieved. Pull production implies high and stable quality of components, which is ensured in the combination of "Lean production and Total quality management" (Lapshina, 2019). Otherwise, the presence of interoperable defects will lead to the order execution failure and losses.

It is known that in lean manufacturing, information about how many work pieces are required for the next operation or how many of them should be in a batch is transmitted using cards (order, selection) (Lapshina, 2019). Thus, if in push production the worker, as a rule, knows how many work pieces he has to make per shift, then in pull production he makes as many of them as indicated on the card, and this must be done as quickly as possible. It should also be borne in mind that there is a so-called "minimum launch batch". This means that if the order is small, then the consumer will have to wait some extra time until several such orders accumulate. In such a situation, it would obviously be correct to have a certain stock of finished products of each type in the warehouse.

When developing plans for the lean production introduction, it is necessary to take into account that it is effective in conditions of serial and mass production and in the context of rapidly changing demand (Golyakov, 2019). Hence the emphasis should be put on:

- minimizing decoupling stock; when a new order starts to be executed, the previous reserve will remain unclaimed;
- pulling production, i.e. direct focus on a specific order;
- quick readjustment, focusing attention on the task performed, self-discipline of personnel and time of order fulfillment; all these is necessary for prompt and high-quality manufacturing of the required batch of products.

If an enterprise produces the same product for long periods of time, then obviously some lean production introductions will not be as effective and thus it would be correct to pay attention to other approaches to improving production management. In case of single unit production LMS is generally not applicable. However, some of its elements can be useful (Kayumov et al., 2018), namely: “Built-in quality” (technology improvement) and “System - 5 S” (workplace improvement).

6.2. Achieving staff involvement

The author (Kanyukova, 2018) points out that the effective introduction of lean production is possible only with the active participation of all members of the workforce (the principle of “personnel involvement” (GOST R 56020 – 2014, 2014). This is precisely what ensures the aforementioned self-management of the company, its flexibility in solving tactical problems. At the same time, it is important to overcome alienation of employees from the final result, which has always been present. In Japan this is achieved through supporting measures for each employee, a desire to create such conditions that would retain them in the company for the longest possible time. Here we should also mention quality circles, which serve both as a tool for discussing industrial cases and a way to improve the education level. The circle of quality can function efficiently only under high level of employee adaptation at the enterprise (Wood & van Veldhoven, 2012), when they begins to feel themselves a person who the success of the company depends on.

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There is one more effect of the LMS introduction, which may be ambiguously perceived by the staff as a release of labor, which may become the reason for jobs reduction. In works by Frankiv (2019) it is indicated that this can lead to internal slowdown in the company and resistance to change. Here, again, we can give an example of Japanese management and its personnel policy, when an employee after cutting his workplace, as a rule, is kept in the company. This circumstance is undoubtedly one of the factors that predetermined the success of lean manufacturing at Japanese enterprises. Managers implementing LMS should take into account that it undoubtedly requires much greater efficiency and concentration on solving emerging problems from the personnel, flexibility of thinking and, in general, more intense mental and physical efforts. In case of Japan, this circumstance can be compensated by the prospects for many years of successful work in this company. In the conditions of Western and Russian management, there is undoubtedly a need for immediate and sufficient material remuneration in order to maintain or even increase personnel loyalty while the workload increases. At the OJSC KAMAZ enterprise, considerable attention is paid to personnel motivation (Dolgopyatova & Khomyakova, 2016). In the Declaration "On the KAMAZ Production System" a number of responsibilities are assigned to the enterprise administration. Therefore, managers should give a personal example of high standard professionalism and production culture; create conditions for the development of employee's skills and promotion of the most capable ones. The personnel appraisal system based on the "key performance indicator" has become a key in determining the amount of material remuneration and in making decisions in situations of staff reduction.

One of the works (Puzanova, 2020) tells about the production process at JSC "Belgorod refrigeration plant" and mentions a high degree of equipment wear. This circumstance leads to breakdowns and productivity decrease. Further, the author proposes to reduce losses by introducing such elements of lean production as universal equipment maintenance (the article uses the term "Maintenance and repair system") and staff motivation: fixers - to reduce setup time, and operators - to promptly eliminate small breakdowns and malfunctions. Obviously, such approach can only be correct on a tactical scale. In the longer term, wear and tear on equipment, of course, cannot be compensated for by additional staff efforts alone. The standard (GOST, 2014) states "respect for a person" as one of the values of lean production, and "building a corporate culture based on respect for a person", "continuous improvement" and "strategic focus" as principles. It follows from this that along with the diligence and efforts of operators and fixers, work should be carried out to replace and modernize equipment.

In one of the works (Klekovkin, 2017) it was emphasized that the success of lean production introduction largely depends on the level of the company self-management. Self-management in this case refers to the firm's ability to change under the influence of internal forces and factors, i.e., in fact, it is the ability to evolve. It is indicated that effective self-management is possible with an optimal balance of factors such as highly effective interaction of elements, and on the other hand, with the correct setting of goals and objectives. The company is a rather complex system and its successful functioning is possible provided that dynamic equilibrium is achieved, including an adequate response and adaptation to changes in the external environment. Introducing LMS is, in fact, a new and effective tactic in responding to external requests. It is also indicated (Klekovkin, 2017) that the level of self-management of the firm should exceed the turbulence of the external environment. Obviously, the turbulence of the external environment can vary greatly and will be different, for example, for company A which produces food, and for company B which

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manufactures strategic nuclear submarines. On the other hand, the level of technology in company "B" can be significantly higher than in company "A" and, obviously, this also requires a certain self-management. If we want to raise labor productivity in both companies, then this directly requires a certain resource of self-management, since we want to achieve this goal without significantly changing technological processes and with the help of approximately the same employees as before, with the proviso that they probably receive additional training. Thus, the possibilities of self-management can be used in solving various problems, including the introduction and maintenance of lean manufacturing. The level of self-management is closely related to the socio-psychological atmosphere in the company, to the quality and nature of the corporate culture, which must be built thoughtfully and persistently. As noted by researchers (Dolgopyatova & Khomyakova, 2016), Toyota's success was associated with a combination of respect for each employee, taking into account their interests on the one hand, as well as high demands on them and a request for complete dedication, on the other hand.

6.3. Regulatory framework for LMS in Russia

National standard of the Russian Federation “Lean production. Basic provisions and glossary” (GOST R 56020 – 2014, 2014) is intended to provide methodological support of the system under consideration. Lean Manufacturing in the standard itself is described as a concept allowing one to increase both quality and productivity, as well as optimize the company management. In the opinion of an ordinary Russian or Western manager, a simultaneous improvement of all three indicators is a feasible task only on condition of significant financial investments. For the concept of lean manufacturing, which was developed in Japan, these several indicators do not contradict with each other; and the set of goals is supposed to be achieved with the help of philosophy, values and principles. The philosophy of lean manufacturing is very concisely explained in the standard, and its detailed content obviously lies in the values and principles set out below. In total, six values are named. Interestingly, safety comes first, followed by value to a consumer. Customer focus is highlighted separately and is in the middle of the list. This is followed by "Loss reduction" and "Time", and the last - "Respect for the person." Together with the “Taboos” and “Prohibitions” mentioned below, this indicates that the drafters of the standard took into account the fact that its origin is associated with the East, which is characterized by a synthesis of traditional and modern, rather than strict Western technocracy. The principles outlined below correlate both with values and with the principles of total quality management, with a slightly greater emphasis on the internal mechanics of production ("Organization of the value stream for the consumer", "Pull", "Built-in quality"). The standard mentions “four levels of value creation”: at the inter-organizational level, at the organizational level, at the organizational process level and at the operations level. In the light of Lean manufacturing the standard further sets out the aspects of organizational structure, leadership, employee engagement and motivation, and eight Lean manufacturing tools. The "Glossary", in particular, contains a detailed description of the types of losses. So, for example, “overload” [of equipment and operators], “unused personnel potential”, “insufficient value [quality] of products” are indicated as “losses”.

Lean manufacturing suggests reducing losses by building value stream maps (Gubaidullina & Karacheva, 2017) and identifying overhead costs. When analyzing the list of losses contained in the standard, one can note a striving for harmony characteristic of the East, and not for the rapid achievement

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of minor goals. In the practice of Western and Russian management, “overloading” or neglecting personnel abilities are considered as a common phenomenon that does not carry negative meaning, since the emphasis is on fulfilling the set of goals, primarily focused on gaining profit. "Insufficient value" indicates a situation where the product does not meet the needs and expectations of the consumer. This means that the manufacturer must work “not for fear, but for a full due,” avoid being limited to compliance with formal requirements.

Modern quality management systems are often criticized for excessive formalism and bureaucracy. Nevertheless, after the introduction of LMS at OJSC KAMAZ, the document decreased three times (Frankiv, 2019); so did the number of meetings. Thus, the focus is made on the farm nature of LMS and corresponding standards; the need for each enterprise to build its own effective LMS system, in which all losses are minimized, including excessive work with documents, is emphasized.

6.4. Introduction of MLS at Russian enterprises

McLaughlin, (2017) is noted that in the UK LMS is being more actively implemented by companies with strong international connections, which has been also proved by Russian experience. One of the pioneers of lean manufacturing in Russia is PJSC KAMAZ, where the corresponding project initiated in the mid-2000s [20]. The success of this project triggered the introduction of lean manufacturing principles in early 2010 at such large enterprises of Tatarstan as OJSC Tatneft, OJSC Kazan Helicopter Plant, OJSC Production Association Yelabuga Automobile Plant, etc.

A significant role in the introduction of lean production at Russian enterprises is played by the National Project "Labor Productivity and Employment Support" (2018), which has been implemented since the autumn of 2018. With this national project the government seeks to stimulate enterprises to reduce the costs associated with spoilage; lack of efficiency; excess stocks of finished products, raw materials, and semi-finished products. The enterprises participating in the project get access to preferential loans, and are assisted in improving qualifications of their personnel. In addition to the mentioned National Project for lean production, a number of programs were adopted at the regional level, for example, the Departmental target program "Development of mechanical engineering and metalworking in the Udmurt Republic in 2011-2013" (Davydova & Yakovleva, 2011).

In Penza region, a number of enterprises participating in the National Project is constantly growing. Among them is the casting and mechanical plant "MashStal" (2020). This company receives recommendations in terms of introducing the concept of lean manufacturing, more rational use of production space, optimizing logistics and training employees in new principles. The training is provided by the employees of the Autonomous Non-Profit Organization "Federal Center of Competence in the Sphere of Labor Efficiency", with the emphasis on the application of the process approach and the use of lean manufacturing tools. Attention will also be paid to improving the working conditions in molding shops. Importantly, LMS should have a beneficial effect even with such a completely successful enterprise as Casting and Mechanical Plant MashStal, which was included in the top three in Russia at the end of 2019. According to Kochetkov (2020), the head of Stankomashstroy company, which also joined the National project, one of the main conditions for the successful lean manufacturing introduction is revision of old approaches to work management.

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7. Conclusion

It can be noted that LMS as a single concept is applicable in the case of a flow-line form of production management. Nevertheless, many of its elements are effective in the case of a group and workshop forms. The success of LMS with a particular enterprise depends on the management motivation and to what extent they are able to involve the team of the enterprise in the effort to reduce costs, increase productivity and improve quality, which should be facilitated by a properly built corporate culture.

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