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Pull Strategies in Production Management

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Abstract

The article deals with possible approaches to the management of manufacturing organizations. The authors emphasize the need for integration of lean management with eco-innovation. This integration represents a sustainable development so that environmental impacts are reduced, more effective use of natural resources are achieved and production costs are reduced. Manufacturing organizations based on that approach must use so-called pull production control systems. Pull systems are most often presented in production management system - Kanban. The second part of this article deals with specification of these systems and development of pull strategies in production management in order to increase efficiency of manufacturing enterprise.

Keywords: Production management, development trends, manufacturing enterprise, pull systems.

Introduction

The economic crisis requires new thinking and behavior of organizations and managers. We cannot wait to the retirement of crisis. It must be accepted as an integral part of the macroeconomic situation, in which we currently are and do business. The crisis should teach us to think more ahead, to look for new ways of effective production and to think about possibilities to rationalize all activities, in introducing new products and services to market.

The debt crisis often examines the viability and ability of many managers to lead organization. Organizations must flexibly respond and use so-called „lean” thinking in order to satisfy customer requirements. Development and regulation of lean organization is governed by the design of nature. Each worker carries in himself the same principles, as every cell of human body carries same genes. Based on these principles, each organizational unit is able to realize their own roles within the purpose of whole organization. Managers who want to accept the crisis as a motivational factor should use the following ideas of lean management [1, 2].

Proactive thinking - future actions must be anticipated, proactively thought out and formed. This attitude will be immediately reflected in swift

response to the current role - according to the motto: "Do it right at first attempt!"

The overall thinking - It is necessary to change the angle of view and see all the respect of their action. General view recognizes more problems on the horizon and value of their own decisions.

Potential thinking - allows unused resources to address the issues. It allows improving relations and cooperation between suppliers, customers and competitors. It supports improved communication and enhances the development of contacts and common problems solutions [3].

The economic thinking – is focused on the elimination of all types of wasting. All actions that do not create value are considered as wasting. Even today the position of world producers are not the result of short-term effort, but long-term right strategically oriented and intrinsically interrelated efforts of the whole complex of activities, from development through research, production to export. Determination of critical factors affecting the competitiveness of manufacturing companies is not easy. The performance of the company depends on the correct choice of the structure and success factors that will prefer the company of domestic and

international market [4].

Performance indicators, which should be accepted by production organizations are shown in the figure below (Fig.).

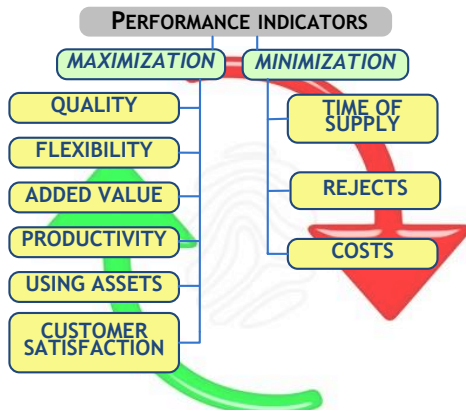


Fig. 1 Performance indicators of production organization

In this paper, we analyze the pull strategies in production management in order to increase efficiency of manufacturing enterprise. The paper is organized as follows: Section 2 discusses the integration of lean management with eco-innovation. Section 3 introduces the pull strategies in production management. Section 4 introduces the evaluation of pull systems. Section 5 gives conclusions.

The integration of lean management with eco-innovation

The debt crisis has many negative impacts on the organization. It's mainly decrees in production and services, reduce the volume of foreign funds to finance organizations activities, decline of long-term investments and also often occur unpaid debts. Practical experience suggests that in order to reduce costs often leads to demands of suppliers to reduce prices of purchased goods and services. This is in many cases liquidating, especially for small and medium-sized organizations. It leads to spiral formation, when efforts to maintain some organization often causes problems even the ruin of other organizations. Many organizations have used the crisis to reorganize its operation with a lean management, reduction of unproductive costs and use of energy saving and environmental solutions [5].

Many organizations, especially manufacturing, integrate lean management of eco-innovation. It turned out that that integration creates conditions for sustainable development. They reduced

environmental impacts. This is more efficient use of natural resources which often markedly reduce production costs [6]. Manufacturing organization based on that approach are trying to use (if permitted by the conditions of production) so-called pull production control systems. The philosophy of these systems is engaged in the following section

At present, it is appropriate to use the full potential of eco-innovation, environmental protection, to promote competitiveness, growth and job creation. [7]. It is necessary to ensure that the EU maintain a sustainable competitive to other parts of the world. Eco-innovations are key technologies (Cleantech) to the environment [8]. Cleantech is also economical and ecological solutions to enhance productivity, efficiency, saving energy costs and thus the environment. Currently, the Cleantech referred to as a separate industry [9]. Although many Cleantech organizations essentially manufactured, but help improve the business types of organizations. Cleantech is not only business with renewable energies. It is also about water purification, more efficient transport, production of organic products, improving materials, but also on the design and architecture. Cleantech is a logical response to trends such as lack of resources, urbanization and climate change. Cleantech organization grew during the crisis. The principles of environmentally oriented business for profit are shown in figure 2.

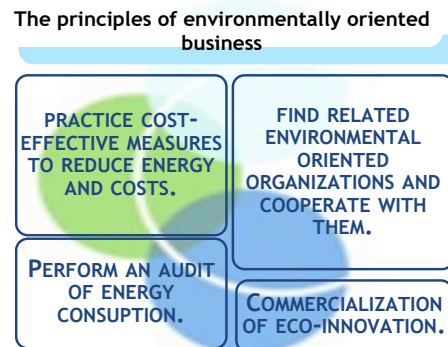


Fig. 2 The principles of environmentally oriented business

Cleantech solutions are suitable for all industries. It is important to take this trip not only management of the organization, but all employees of the organization.

Routine and repetition of the old imitation of something, already used by others does not have place in lean management strategy. Only organizations that bring new products, new

technologies, new ways of meeting market needs, new ways of reducing costs etc. can be successful. During the crisis, it is necessary to deal with more innovation, invest in people and prepare for opportunities in the future. The crisis is an opportunity for those who have something to offer, for example knowledge, skills, innovative thoughts and honest work done. Integration of lean manufacturing with eco-innovation, aiming at significant and demonstrative progress, leads to a requirement for a new way of managing the production, which should use the principles of pull systems.

Pull strategies in production management

Experiences in the automotive and electronics industries confirm the high topicality of the principles of pull production management system in terms of mass production [10, 11]. On this issue in practice exists different conditions and results. Pull systems are most often presented in production management system - Kanban. Push systems of production are currently used by most organizations. Production planning system should transform the push strategy to the pull strategy. Push strategy is characterized more points in production (machines or technologies) that must be controlled centrally (Figure 3).



Fig. 3 Push strategy

In contrast, in pull systems (Figure 4) there is minimum of these points (one is optimal), while other stages of the production process are managed in a decentralized manner to the suggestions from this point. This means that production orders from the planning department receives only one process and the others are managed by following orders from this process.

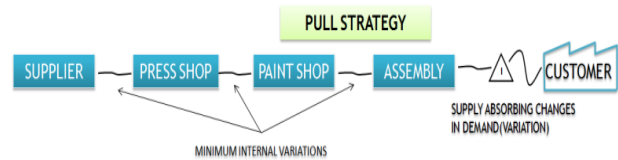


Fig. 4 Pull strategy

In practice it is difficult to clearly determine whether it is a purely push or pull production principle. To determine the type of production system in terms of push and pull, we propose to use the following chart (Figure 5), which will help to answer the question whether the organization is closer to push or pull production management system.

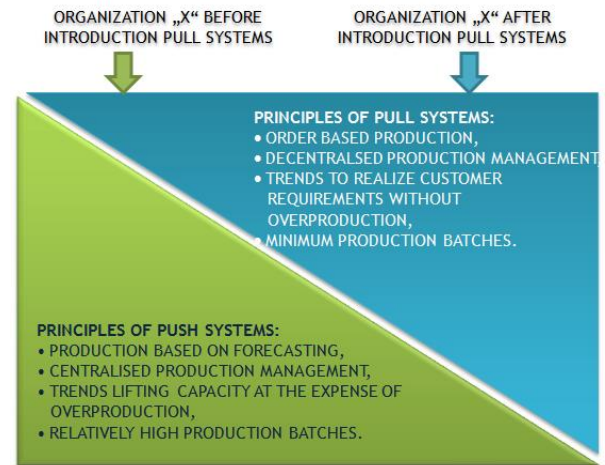


Fig. 5 Descriptive diagram of pull and push systems and their mutual intersection

The current pull systems have of course also many weaknesses. Based on our own experience these deficiencies can be selected as followed:

- misunderstanding of the basic prerequisites for the implementation of pull systems in terms of the implementation team and top management,
- lack of identification and solution of the basic prerequisites for the implementation of pull systems,
- low visual management functionality,
- lack of production data collection and complicated recording and processing of data,
- lack of methodology for evaluation of the state of pull system.

Representative of pull system is a workshop production management - Kanban (Figure 6), which we give more attention below.

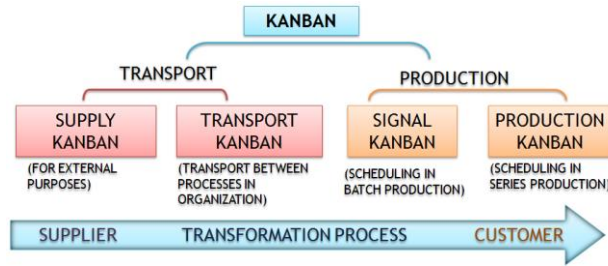


Fig. 6 Distribution of Kanban systems by way of use

Kanban systems can be divided into:

- sequential Kanban system,
- filling Kanban system,
- requesting Kanban system.

Sequential Kanban system is suitable for use in manufacturing based on the particular order. The system is useful for the types of production with a wide range of products. It ensures the production of parts in the required quantity, time and quality. The card is a replacement for production order.

Filling Kanban system - Kanban system of this type should be chosen in the workplace, where several produced parts are entering into the final product (e.g. a, b, c). If the chosen production cycle is 2 days, then in the first and the second day we will produce product that will be assembled to the final assembly in the third and 4 day.

Requesting Kanban system, according to its principles is one of the best-known pull systems that is usually described in most literature. The principle of its functions is best explained by the so-called saw diagram. The signal levels issue is closely described in the following section.

Features of the mentioned Kanban systems have become the basis for the design of model of pull system that is used for the implementation and improvement of other pull systems (Figure 7).

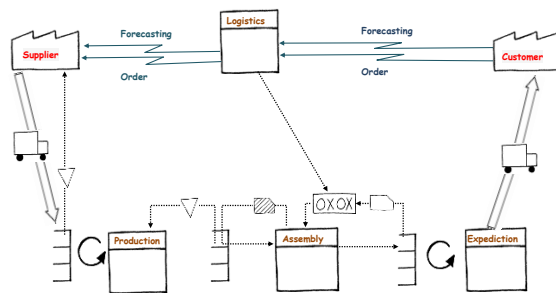


Fig. 7 The standard model of pull system

A complex model of pull system can be divided into few basic parts, which are shown in Figure 8.

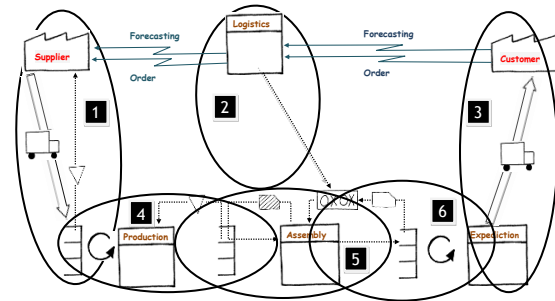


Fig. 8 The distribution of a comprehensive model of pull system

Legend to figure 8:

- 1 - pull system - supply of materials,
- 2 - planning and scheduling systems for pull system,
- 3 - product ordering and shipping,
- 4 - pull system in pre-production processes,
- 5 - pull system in the workplace supplying,
- 6 - pull system in production processes.

Automated systems for goods ordering

Electronic systems for ordering products are used in all commercial fields. The strong growth of transactions conducted via electronic ordering systems and cost savings was not only showed in industrial companies but also in banking institutions (credit cards, Internet banking, etc.) especially in the last decade. For communication between customers and manufacturers we recommend using the following communication tools (Figure 9).

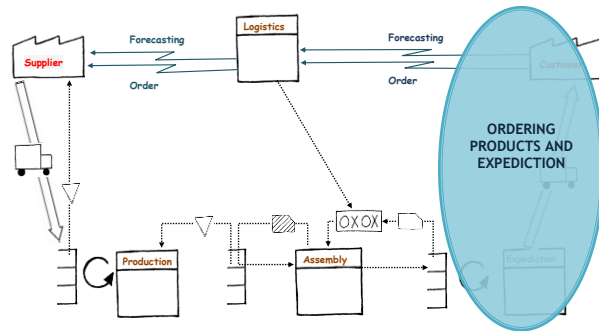


Fig. 9 The allocation of the segment of electronic commerce for pull systems

Fax usage in pull systems - for the purpose of sending orders to frequently used fax messages. Use of e-mail in pull systems - e-mail is in practice often used to send orders and forecasts. The use of EDI in pull systems - EDI (Electronic Data Interchange) is often used in automotive, but also in electronics industry. The time from ordering parts till their delivery is important in the Kanban supply system. The ordering method is usually suggested by customer. However, if the organization can still choose, we propose to review the following areas:

- initial investment in software, hardware and training,
- operating costs including the costs of repair and recovery,
- continuous time from order to delivery of parts,
- reliability of the system.

Planning and scheduling for pull systems

Custom control can be simply described as a sequence of steps (processes) between taking orders from a customer to receiving payment for the product. Custom control is a summary of financial management, information and material flows. In most cases the financial and information flows are more complex and time consuming operations. Production should be arranged in the order to meet customer requirements. The methodology to determine the optimal sequence for selected criteria - deals with the uniform schedule to minimize inventories and production of intermediate times, but does not directly view to an equal load on resources (operators, equipment) on the line, even load logistics, minimizing the sort time, or determine the

weight of such criteria and determine the mix by all the rules together.

Production Kanban system with support for information technology

Features of traditional manufacturing Kanban system are largely limited and therefore it is suitable mostly for series production (figure 10).

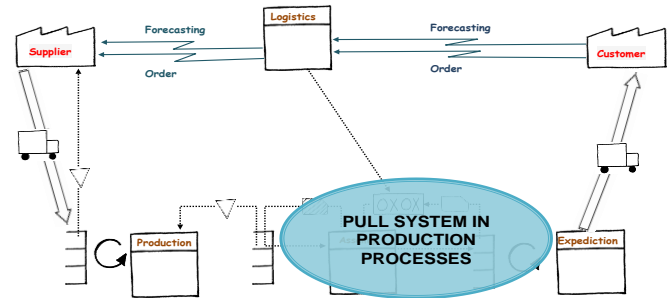


Fig. 10 Sizing of pull system for final assembly and production

The traditional manufacturing Kanban systems have three basic tasks:

- start production at the right time (based on JIT),
- give information about the product (type, specification, dosage, quantity, etc.),
- give information about the production location and its customers. The role of the Kanban production system with information technology support is to add other functions to the traditional tasks, necessary for efficient production management.

Signal Kanban system with information technology support

In the design of mechanisms to manage inventory can be assumed to maintain the MRP, while proposed pull system can represent support function. (Figure 11)

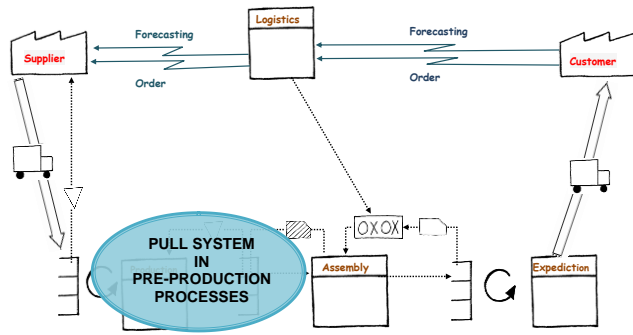


Fig. 11 Definition of the pull signal systems in the organization model

- manufacturing and assembly work,
- system of production logistics (handling of parts, cards and work with information technology),
- storage of parts or the department from which it supplies.

The advantages of this connection are the real time reactions as well as the possibility of rapid calculations of capacity by which are generated Kanban production cards. Procedures for operating the transport Kanban system is shown in the flowchart (Figure 13).

The introduction of the expected identification, tracking and updating of the three control parameters: the insurance reserve, the signal level, the maximum level. The introduction of the proposed mechanism is not necessary to monitor the actual stock on hand and its development, but the layout of a stock that is equal to the sum of available stock on hand and inventory on the road. That requirement is necessary to adapt the information provided by information systems.

Kanban serves to supply supporting information technology

Supply Kanban system is used mainly to supply the manufacturing and assembly workplaces, or to order parts between two warehouses (Figure 12).

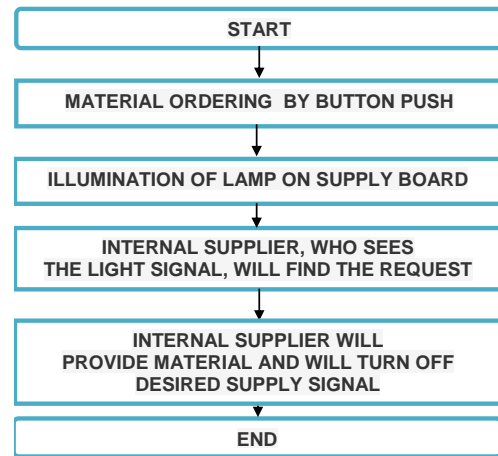


Fig. 13 Flowchart of simple inventory system with information technology support

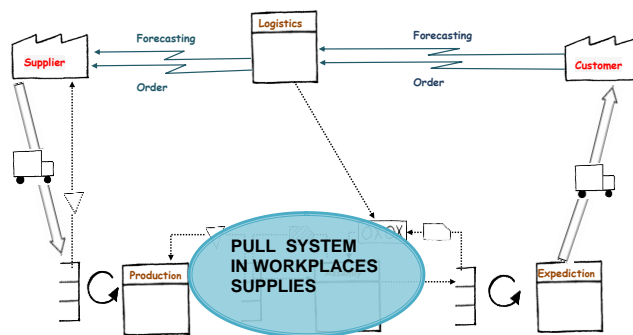


Fig. 12 Definition of Kanban system for supplying in the model of pull system

Supplier Kanban system with support for information technology

Supply pull systems are associated with the system for ordering products and by supply systems (Figure 14). The difference is that in the external supply Kanban system, the goods must go through several administrative procedures. Continuous delivery time is much longer and more variable, what is a sign that the process of external supply is more complicated. To create an application of the supply system with the pull principles it is sufficient to use PHP language. All communication between customers and suppliers runs via the Internet.

Kanban system supply circuit comprises:

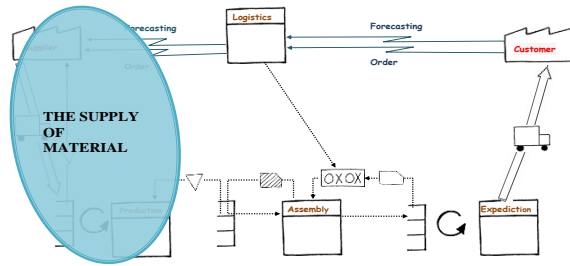


Fig. 14 Determination of pull system for supplying through value stream map

Customer can design the application according to his or her needs. The application can also be used in the internal Kanban system. Total labor intensive of programming such an application is consistent with programming websites.

Evaluation of pull systems

Summative evaluation of pull system usually consists of three components: early implementation, average of the four basic proposed parameters (according to production schedules, delivery reliability, value added tax rate and performance of processes), Kanban system reliability based on the audit of Kanban cards. We propose to assign weights to each of the indicators. Weights are listed in the following example (Table 1).

Table 1 Example of summative assessment calculation.

Type of assessment	Value indicators	Weight rating	Total score
Before implementation	25%	50%	12,5 %
Average indicators	42%	30%	12,6 %
Reliability Kanban cards	91%	20%	18,2 %
The degree of implementation of the pull system	X	x	43,3 %

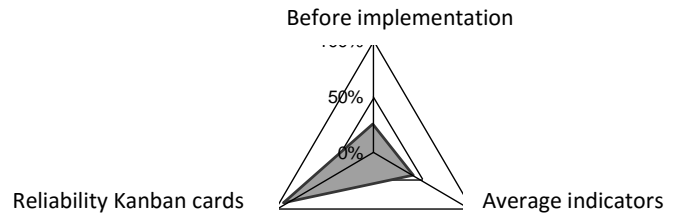


Fig. 15 Diagram showing the three-dimensional evaluation of the pull system

The previous section presented several views on the pull systems. The following text briefly summarizes the basic ideas related to pull systems. These methods have not been on such a scale previously described in conjunction with pull systems in any available literature.

By this we also indicated the trends in pull systems for the future. Important part of pull system model is methodology of uniform distribution of products for mass production. It is desirable to realize that by methodology for scheduling it is possible to create a schedule aimed at maximum output of logistics, and maximum power of the assembly line.

Conclusion

By using a set of indicators it is possible to evaluate the functionality and benefits of pull systems. Manufacturing organizations should use the pull production control systems, since the implementation of a comprehensive pull system, or selected parts in selected organizations achieve the following improvements:

- application of clear standards, accountability and discipline in the management of production,
- increase the productivity of supply,
- cost savings on supplies,
- saving money for the purchase of new packaging units, reduction of idle time on assembly lines.

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