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STRATEGIES OF PRODUCTION CONTROL AS TOOLS OF EFFICIENT MANAGEMENT OF PRODUCTION ENTERPRISES

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Abstract:
The paper discusses the problem of principle methods of production control as a strategy supporting the production system and stimulating efficient solutions in respect management in production enterprises. The article describes MRP, ERP, JIT, KANBAN and TOC methods and focuses on their main goals, principles of functioning as well as benefits resulting from their application. The methods represent two diverse strategies of production control, i.e. pull and push strategies. Push strategies are used when the plans apply to the first and principle part of production and are based on the demand forecasts. Pull strategies are used when all planning decisions apply to the final stage and depend on the actual demand or orders from customers.

***Key words**: JIT, KANBAN, MRP, production companies, production control strategies*

INTRODUCTION

At present action of production enterprises, shaped by the paradigm of sustainable development, are directed at satisfying increasingly more demanding pro-ecological Leeds, which forces companies to operationalize their activity. In order to satisfy the market demand sufficiently, and at the same time meet the ecological challenges of the contemporary world, enterprises should focus on supporting the production process. Contemporary technology, which enable combination of all relevant data into one system and select appropriate methods of planning, allows to „control" production, designate supply for resources appropriate for each production or logistic stage. The application of the strategy of production control allows to improve the process of planning, specify the demand for material in a rational way and assure the continuity of the logistic process of production.

The aim of the paper is to present the efficiency of MRP, ERP, JIT, KANBA and TOC strategies and specify the benefits resulting from their application, among others lowering time consumption and costs, improving coordination and the efficiency of the system of the flow of goods. The paper is theoretical-analytical in character and based on the research in background literature.

REVIEW OF „PUSH" INSTRUMENTS

In the background literature the following instruments of production control are enumerated: strategies, systems and methods describing the way of functioning of enterprises as well the flow of their production processes. These include „push" strategies which consists in the introduction of production schedule and central planning. In such systems production is based on forecasts of orders and „pushing" the product to the subsequent process. The demand for the product is set at the system input and in specific internal points, which the balance of the demand for materials [1], or technological balance of the amount of necessary materials resulting from need for particular resources and production capacity of the enterprises. Hence it is easier to specify to what extent the amount of used materials compares with the amount ready-made products received or potential losses [19].

MRP (Material Requirement Planning) is one of the instruments. The method combines Stock control with production planning, and allows to solve the problems connected with labor coefficient of calculations and the time spent on data processing. The system supports stock management and makes planning supplies easier [25], assuming that the requirements gross must be satisfied on the basis warehouse stock, and production or purchase of materials are commissioned when the reserves are insufficient [14]. The aims of MRP include the determination of the time of supply of raw materials or semi-products, costs of production, better use of infrastructure, quicker reaction to changes in the environment and control over the realization of particular production stages [8].

MRP demonstrates the algorithm for acquiring information relevant for its correct functioning. At the initial stage of planning the requirements, demand forecast is performed, supplanted by warehouse inventory entered into the system. On this basis, the main production schedule is developed which specifies the moment at which orders for raw materials and materials must be placed in order to commissions orders in time [25]. The MRP planning system is presented in Figure 1.

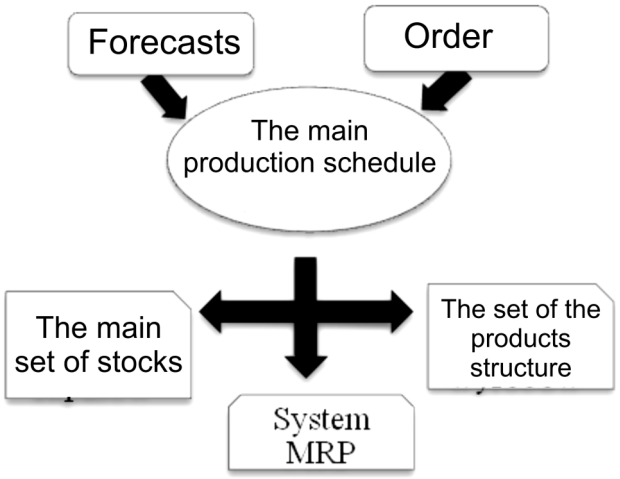

Fig. 1 MRP planning system
Source: [7].

MRP collects information from the production Schedule, which contains amounts and dates of availability of products, warehouse inventory and BOM (Bill of Materials). The data generate production schedules for each of the elements. The diagram of the MRP system in production is presented in Figure 2.

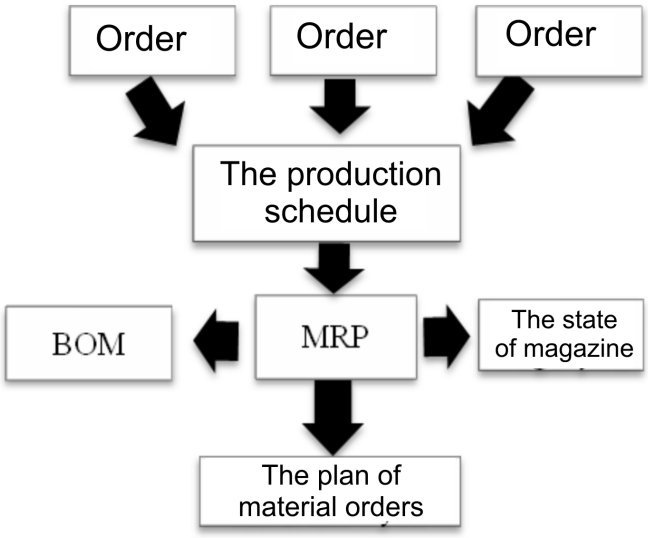

Fig. 2 MRP system in production
Source: [8].

MRP was created in 1964 in response to the program of the Toyota Corporation, and Black & Decker was the first company which used it. Despite complexity and difficulty in implementation of changes, forecasting, specification of the volume of orders, delivery dates and the volume of production batches were combined into one system, whereas the processes of production planning and control became shorter and more effective [12]. The level of reserves was lower, long-term planning of the production capacity became possible and the flexibility of stock was increased [11].

The „push" strategy includes the ERP system (Enterprise Resource Planning) initiated in 1950s. The tasks of the system include warehouse stock management and the techniques are based on the methods of forecasting and the method of the point of order. Decisions concerning future purchases are influenced by the amount of reserves and information about use in previous periods [7].

The evolution of the system preceding ERP is presented in Figure 3.

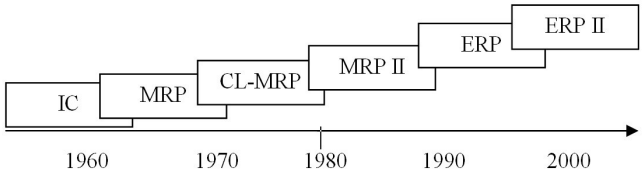

Fig. 3 The evolution of planning and production control systems
Source: [7].

ERP focuses on activities concerning ordering, production and distribution as well as customer service, finance, integration of the logistic chain, management of construction and technological changes and quality management [4].

Despite the fact that the system concentrates on the external activity of enterprises and requires a significant IT back-up [19], it constitutes „the condition of surviving companies on the market" [15] and its application may to a large extent improve the quality of customer service and the services offered.

REVIEW OF „PULL" INSTRUMENT

„Pull" strategies are another instrument discussed in the background literature, and follow the principle of suction which consists in ordering production when the demand of the customers has been specified, which decreases the necessary space and lowers the costs of warehousing.

The JIT method (Just in Time) was created by Henry Ford, who applied it for the first time in 1920s in order to synchronize production. JIT consists in the delivery and storage of raw materials, materials, semi-products and ready-made products in such amounts, time and place, which allow to manufacture and deliver products in accordance with the current demand. Despite difficulty resulting from forecasting and finding suppliers delivering small amounts of goods [19], after the elimination of intermediate points of storage and realization of delivery directly to the production line, it is possible to achieve continuity and flexibility of the production flow [13].

The strategy should include suppliers and consignees, and on this basis the following 10 principles of the implementation of the strategy were developed:

1. Suppliers should be located in the proximity of the factory.
2. Deliveries should be realized in small batches, and dispatches should be frequent.
3. The supplier is responsible for the stock.
4. It is the best to have only one supplier.
5. The supplier who is the only source of materials enjoys special attentions.
6. Suppliers with wider qualifications may reduce their delivery.
7. Suppliers must offer competitive process, high quality and respond quickly to production requirements.
8. Consignees should offer technical and financial support to the suppliers.
9. Quality is demanded by the consignees and achieved by the suppliers.
10. Consignees and suppliers must trust each other.

In a broader sense JIT is based n the elimination of wastage (Japanese muda) and consists in constant improve-

ment of the processes of the flow of products and information. Quality should be improved on a permanent basis which allows to avoid wasting time, energy, capital, materials and losses, and eliminates excessive bureaucracy or inappropriate relations with suppliers and staff [19].

The JIT method was popularized by TaiiChi Ohno, the deputy president of Toyota, thanks to whom the time of retooling machines and facilities was reduced to 1 minute [23]. The reason for looking for new solutions resulted from insufficient productivity of the company in comparison with the competition [20].

In 1950s Toyota developed the Kanban system, i.e. the system of the organization of delivery of production materials [16]. In traditional manufacturing the production schedule applies individually to each process, Kanban combines and synchronizes production [9] and controls the transfer of materials depending on the signals from the process at the bottom of the stream, taking into account time and volume. The Kanban idea can be described by the following slogan „seven time – no: reserves, lack, idleness, delays, irrelevant technological processes, transfers, queues" [18].

Physically Kanban is a simple paper card (Figure 4) on which information concerning materials is placed. They signal the need to transfer materials in the production process, from the external supplier or production facility. After the exhaust of reserves, the card should be delivered to the supplying unit, which in turn should start actions concerning the supply of the ordering unit with materials [2]. Kanban is a production order meaning the requirement for supplying a particular work station or a customer [10].

Fig. 4 Example of a Kanban card
Source: [10].

The aim of the card is to prevent over-production and excessive transfer of materials, provide processes with specific orders and support the staff supervising production in determining whether production is ahead or behind the schedule [9]. Introduction of the system requires reorganization of the IT structure of the company in order to prevent problems with the identification of cards [13], yeti t has many advantages, among others increasing productivity, decreasing the level of warehouse stock and costs and finally increasing the competitiveness of the company [10]. Toyota is a good example illustrating that the system is efficient, after three years from its implementation the company achieved the following results:

- 75% reduction of all reserves,
- 95% reduction of lacks,
- 25% increase of production,
- 10% reduction of the production space,
- reduction of the warehouse space,
- reduction of the number of staff employed in warehouses.

TOC (Theory of Constraints) is yet another instrument. It goes back to 1970s when the company „Creative Output" was founded which offered solutions supporting production scheduling described as APS (Advanced Planning System). TOC focuses on the achievement of long-term profit by appropriate management of the existing constraints, occurring in the systems of management or processes of distribution [5].

The theory perceives constraints as an element of reality and distinguishes two major elements: explaining the casus of the occurrence of negative consequences of constraints and presenting the way in which such consequences can be eliminated or reduced [17]. The principle stages of action answer the following questions:

1. What must be changed in the organization?
2. What is the replacement for the change?
3. How should the change be performed?

The stages are cyclical and based on the process of constant improvement [17].

Project management is based on the CCPM model (Critical Chain Project Management), which Chile ta king into account the contingency factor, allows to achieve all primary goals of project management [24].

Project management is based on the DBR solution (Drum Buffer Rope) which concentrates on the analysis of the condition of the Buffet and identification of the causes limiting the capacity of the production system [22] It is vital to eliminate the factors which result in standstill, and in the situation when the flow of the process is subjected to them, it is necessary to manage the limitations [14].

The adaptation of the method guarantees gradual improvement of results and achieve competitive advantage [21]. Table 1 shows the effects achieved by companies which used TOC.

Table 1
Example of TOC adaption

Company	Hampton Conservatories LTD	JOFCO Inc.
Branch	Construction	Furniture
Location	Ireland	USA
TOC tools	CCMP	DBR
	EFECTS	
Income	Increase	Increase by 30%
Storage	Fall by 70%	Fall by 60%
Net Profit	Increase of productivity by100%	No data
Delivery time	Improvement by60-90%	
Time of realization	Improvement by 50%	Improvement by 75%

Source: developed on the basis of [6] .

Thanks to the adaptation of CCMP in Hampton Conservatories LTD the index of the volume of income was improved and the warehouse storage was reduced by 70%. Productivity grew by almost 100%, the index of delivery on time by 60-90% and the time realization was reduced by half. The dates of project accomplishment became transparent and predictable, quality was improved. The adaptation of DBR in JOFCO Inc. resulted in the increase of income by 30%, decrease of warehouse storage by 60% and time of realization by 60%.

CONLUSIONS

The strategies of production control are introduced in increasingly more companies, which results from the progress in globalization and competition targeting the groups of customers. Companies which are forced to compete, by adapting the system of production control attempt to eliminate unnecessary costs and minimize losses.

The MRP strategy Works Best in companies whose product is complex and the time of processing Raw materials relatively long. It is based on the minimization of stock and according to its principles all needs should be catered for by using warehouse reserves, and production or purchase of materials should be ordered when the stock is too small. This a „push" strategy based on the forecasts of demand of specific assortment.

The ERP system, another type „push" strategy, includes action concerning not only ordering materials but also production, and focuses on distribution. The aim of the adaptation of the system in the company is to strengthen its position on the market, reduce costs and increase productivity as quality of customer management.

Apart from „push" strategies „pull" strategies are distinguished. JIT is one of them, and concentrates on maintaining the volume of reserves at the extent satisfying current de and. Good relations with suppliers and consignees are also important. In companies in which the system was implemented, the cost of the storage of materials was lowered.

The Kanban system consists in the introduction of cards referred to as „Kanbanams", whose task is to increase the efficiency of the transfer of materials between production at the top and at the bottom of the stream. Its most important task consist in performing transfers only when materials are necessary on a particular work station.

The TOC theory of constraints identifies negative effects of the occurrence of constraints and reduces or eliminates them. The system requires constant improvement since constraints e.g. in production may occur cyclically and should monitored and solved by the company.

Most of the systems are based on similar assumptions, whereas each of them focuses on a different issue. Most of them stress the significance of ecological aspects, which at present often determine the level of attractiveness of companies and are relevant for the increase of efficiency, lowering costs of organization, for instance by reducing the amount of material used in production or using energy from renewable resources.

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