



Evaluation of the adaptability of the input of Machine Manufacturing Systems

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Abstract. Subject of the paper is the problem of adaptability of the entrance of the machinery production systems. Available approach to the optimization of deliveries and reserves on the basis of the optimal size of the reserves. The aim of this approach is to reduce the costs and based on this further in the course of the technological process – the cost of the manufactured products. In order to realize this aim, is solved the problem of analysis and selection of analytical approaches and methods in the literature and practice and selection of appropriate approach.

Keywords - Adaptation and adaptability of production systems, adaptability of input, costs about delivery and storage of the materials.

I. INTRODUCTION

The production efficiency, the development of modern engineering enterprises and their competitiveness to a great extent are determined by the degree of their adaptation to the changing market environment. The processes that characterize the economic situation of the environment, often do not meet the conventional theories, which bring us to the conclusion that to cope with the arising problems of the business in these conditions we should be looking for new solutions and approaches.

In the literature the opinions of different authors and researchers are extremely various and can be combined in two comprehensive approaches for the study and improvement of the systems – traditional and systematic.

- In the traditional approach the attention is focused on the separate parts and elements of the structure of the systems, functionally distinct tasks and operations. The problems about the interaction and integration of different activities in a whole are not solved. The adaptability of the systems of this approach is limited to solutions within “old quality”.

In the systematic approach the attention is focused on the interconnection of business factors, which are treated as an integrated set of activities for the realization of strategic and tactical goals that provide the effective work of the subsystems and the systems as a whole. The adaption of the systems of this approach requires analysis and synthesis of the particularities of the individual subsystems and their integrated relationship into an overall system.

- In the traditional approach, the attention is focused on the functional /the technological/ specialization, the hierarchical presentation of the activities and tasks by focusing on vertical links between them. The systematic approach, on the contrary, considers each system as a set of subsystems and elements, connected and interacting between themselves. Besides the individual parts have objective orientated specialization, reporting not only the vertical, but also the horizontal connections and their points of intersection.

One of the most popular conceptions, which can be applied to evaluation of the adaptability of the machine systems, is the famous “Value chain”. Its decomposing means to identify its elements, as it has been done by Michael Porter (1985), who has distinguished nine elements of the chain. The major elements include internal and external logistic, processing, marketing and sales, maintenance. In our opinion this chain can be combined with the systematic approach, but for this its elements can be complemented and enriched with new indicators. In this article we present the possibilities for the enrichment of the methodological approach at the assessment of the input of machinery production systems.

II. EVALUATION OF THE ADAPTABILITY OF THE INPUT OF MACHINE MANUFACTURING SYSTEMS

Neo-classics see exogenously participation of a mediator in the production function by including credit institutions in the financing of economic activity.

Evolutionists are for differentiating of adaptability skills, as a main reason for the variety in the microeconomic dynamic of the environment.

These two areas have gradually converged in the literature under the influence of Prahalad and Hamel (1990),

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which introduce the moderate approach, based on the rational and efficient usage of the resources and evolutionary theses of the authors as Teece, Pisano and Shuen. We are witnessing the appearance of new analytical frameworks of the industrial and engineering companies, which are considered as systems in a set of resources and new practices in the development, result of improvement processes, new vision for the competition and the market dynamic. These two are based on the inheritance of Edith Penrose (1959). He analyzes the role of the supplier as a mediator in the collection of the production resources. These resources consist of raw materials and materials, energy, human resources, information and financial resources and many others. We focus our attention on the raw materials. They consist of a set of potential services. The organization in every enterprise of their acquisition determines how to combine, store and use these resources, which determines their nature of productive carried out resources services. They are on the top of the production process and predetermine the use of the production capacity, "the capacity" of the system, i.e. all tasks and activities, which it is able to realize. Only part of potential resources services, which are in storage of the enterprise, can be actually used at a time. This is the reason for the existence of two forms of delivery and storage of raw materials and materials– transit and warehousing.

The transit form focuses on direct links with the producer of resources and the flexible transport system of delivery. Its advantage is lower costs for storage and warehousing, but problems may arise if the pricing policy of suppliers and irrational use of the capacity of vehicles at small volumes of supply of certain raw materials is changed frequently.

The storage form has opposite characteristics. Its advantage is reduced to relative independence of price changes, the maintenance of smaller transport, but higher storage costs.

The considered contradictory characteristics of both forms have a reason to search for diffusion approach. This has led to wide variety in the literature and practical researches over the last years. Many authors use same terms for different indicators or different performance to introduce many similar concepts. We do not set ourselves the task here to make a comprehensive overview of the terminology and the indicators of this literature. We do not try to synthesize or differentiate the authors. We focus on study and synthesis of the methodical approach that combines positive and negative sides of direct or warehousing form of the delivery and store of the resources.

Both categories of the resources may be identified by their content and purpose.

The content of one part of the costs for logistic /delivery and storage/ show reduction "behavior", on the other – of increase.

Being aware of this contradiction we can apply methodical approach of evaluation of the adaptability of the machine production system of input, based on the foundation of mathematical optimization methods proposed by Atanasov and Georgiev (1984) for production supplies.

If we assume as a criterions for adaptability of the machine production system the total value of the costs for delivery and storage of the raw materials by the formula:

$$R_c = N.R_s + R_i .Z.t_{cx} \quad (1)$$

where:

R_c – aggregate costs for supply and storage of the materials [BGN]

N – amount of supplies [num.]

R_s – costs per supply [BGN]

R_i – storage costs per unit material from the supply for unit time period /month/. [lev]

Z – value of the average current supply

t_{cx} – time for storage of the raw materials [num. of months]

The annual need for this type material is determined by the formula:

$$q = Z.N \quad (2)$$

$$\text{and} \quad N = \frac{q}{Z} \quad (3)$$

$$\text{and} \quad z = \frac{q}{N} \quad (4)$$

The delivery interval months of is determined by the formula:

$$t_s = \frac{T}{N} \quad (5)$$

where:

T – years of optimization of stocks in months.

$$\text{Then: } T = t_s.N \quad (6)$$

$$\text{and} \quad N = \frac{T}{t_s} \quad (7)$$

Storage costs of the material of unit interval of delivery are:

$$\frac{Z.R.ts}{2} \quad (8)$$

The costs of unit interval are:



$$\frac{Z.R.ts}{2} + R_s \quad (9)$$

The aggregate costs for the period of optimization are:

$$R_c = \left(\frac{Z.R.ts}{2} + R_s \right) \cdot N \quad (10)$$

Since the second derivative dR^2 tends to zero, the function has a minimum of:

$$Z_{opt} = \sqrt{\frac{2R_s \cdot q}{R \cdot T}} \quad (11)$$

So we get the optimal size of the supply on the input of the machine manufacturing system.

III. CONCLUSION

The adaptability of input of machine production systems is a parameter with contradictory economic characteristics. Through considered approach can be searched optimization for sustaining minimum costs, which gives an advantage at the formation of lower cost.

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