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DETERMINATION OF CRITERIA FOR THE EFFICIENCY OF AUTOMATION AND PRESENTATION OF RELATED FACTORS

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Abstract: *The object of definition of the present development are the criteria for efficiency from the implementation of automated equipment, and the accompanying risk assessment factors. The presentation of the three main variants of automation and their comparison with its social and economic efficiency, aims to facilitate the selection of the appropriate configuration of technological units to meet real human needs and protect business interests.*

Key words: *engineering logistics, automation, efficiency*

The logistical approach imposes requirements on the use of automation of labor activities to organize the continuity of the processes of their implementation. How appropriate and effective its introduction is depends mainly on the extent to which it covers the needs for which it was purchased. The assessment of this implementation includes many prerequisites (fig.1), and the numerical justification is always preferable in proving the need to make such symbolic decisions. It is formulated on the basis of the considered components of process automation and is determined by the technical rules, which, supported by the consistency and logic of the logistic approach, increase the efficiency of the chosen model. In order for it to be optimally useful and applicable, extensive knowledge and special analytical skills are needed to take into account the specifics.

In order for automation to be cost-effective, the cost of operating the equipment and the functionality parameters defined by the manufacturer must be known, which must be compared with the estimated cost of human resources when performing the same activity per unit time [5].

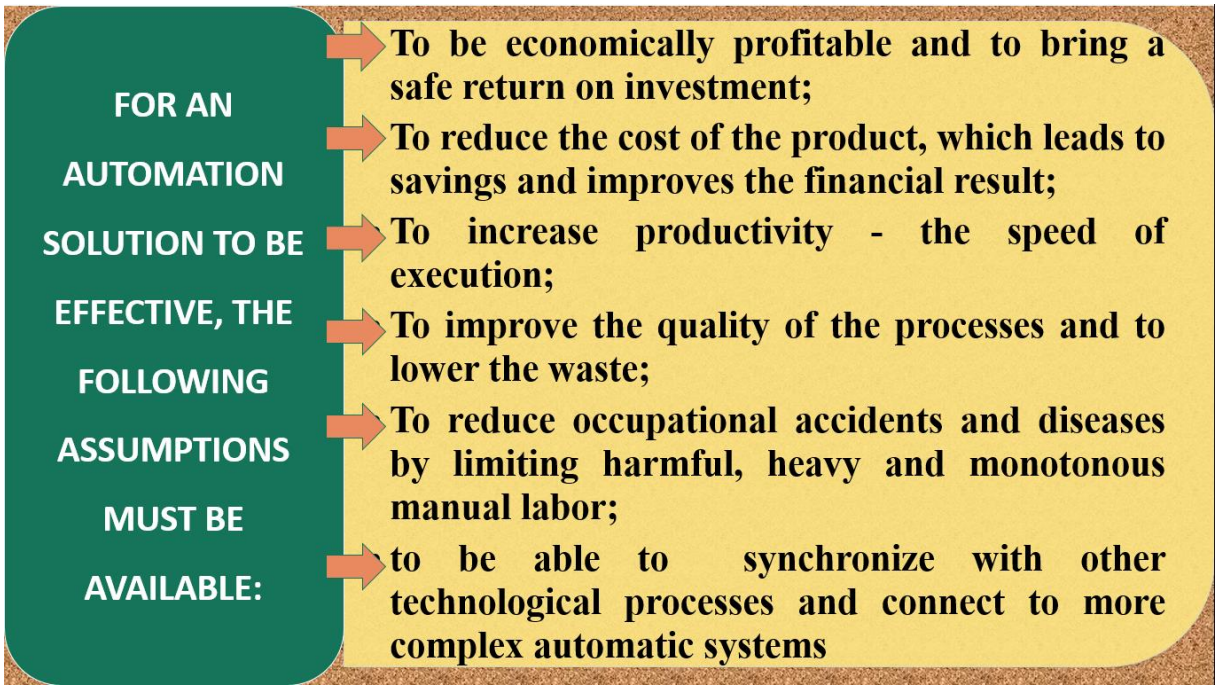

Fig.1 Criteria for assessment of implementation

The ultimate goal of any company is to achieve maximum profit. Its success depends to a large extent on the effectiveness of the decisions taken in it. They are based on facts and data analyzes to determine its capabilities. The degree of accuracy of all judgments in choosing the appropriate concept depends on the degree of automation itself. It depends on the economic power of the company whether it will approach this decision by investing personal funds or will finance its prosperous ideas with borrowed funds. The level of risk is far higher with external financing. The aim is to achieve not only a return on investment, but also the fastest way to achieve the expected profit, with which to catch up with competitors involved in automation with personal funds. Here the question is based on a well-developed credit plan and a statistically estimated credit background. From a financial point of view, this process is related to determining the amount of capital required and the term of their return. Solvency is an indicator that can be determined by the solvency ratio - R_S:

$$R_S = E_C / A_C \quad (1)$$

Where:

E_C is the equity, which may include fixed tangible assets of the company

A_C is the attracted capital from external creditors.

Respectively, the closer to one the result obtained for R_S is, the higher the risk in case of return on the funds attracted in the total investment. Risk assessment does not have a direct financial dimension. There are eco-norms indicating different categories of organic production. In case the parameters of the used equipment do not fit into them due to its low physical and moral level, the companies do not meet the standards and often suffer direct financial damage. This, in turn, damages their reputation and has an indirect impact on profits, as consumer confidence in them declines. Therefore, it is assumed that the creation of environmentally friendly technological schemes, methods and processes is also a priority of the new production concepts.

Engineering logistics, as uniting the goals of all market participants, most often resorts to the use of innovative and alternative methods. In the efforts of engineering to meet demand, the result achieved by the use of an existing resource is compared - conventional, with an alternative one - innovative. Thus, it was necessary to determine the overall efficiency. It is presented with the product of the physical and economic efficiency of the expected change:

$$E_O = E_{Ph}. Ee \quad (2)$$

Where:

E_O is the overall efficiency (in the case of automation);

Ef is physical efficiency;

Ee is economic efficiency.

Physical efficiency expresses the ratio between: the amount of material goods produced at the exit and the used production resources at the entrance, reflected by natural measures (kg, number, meter, etc.). In this case we compare the quantity of processed goods from one machine with that from one worker performing the same operation.

$$E_{Ph} = \text{Output} / \text{Input} \quad (3)$$

Economic efficiency related to automation is the proportionality between: the financial result - the usefulness of the economic activity performed through the automated equipment and the value of the used resources and other costs, ie. Product cost:

$$Ee = Utility / Cost > 1 \quad (4)$$

The requirement to meet the overall efficiency is: E_{Ph} to always be less than one and Ee to be greater than one.

With a transitive relation to this well-known formulation, in real data, it can be proved that automation is a physically efficient process, in terms of the amount of resources used and products produced and cost-effective in terms of investment and realized profit.

The use of manual freight and transport inevitably relies on the application of human effort, which increases the risk of accidents at work, reduces the quality of processes and increases marriage. On the other hand, a malfunctioning machine according to the speed of the processes and the greater number of operations it performs can lead to much greater damage in terms of these same efficiency criteria. For this reason, it is appropriate in statistical quality regulation to consider the parameters for the average, which show the percentage of defective or already discarded products in one batch - Q [%]. When specifying it, the quantity of the damaged ones is compared - D [pcs.], Compared to the total quantity of parts or details in the batch - N [pcs.]. It is calculated according to the size of the specific batch, which is transported by manual or automated loading. For example:

$$N = 1000, \text{ and } D = 5, \text{ then } Q = D / N.\ 100\% \Rightarrow Q = 5/1000.\ 100\% \Rightarrow Q = 5\% \quad (5)$$

As the main criteria of efficiency are the quantity and quality of the product or service produced, this type of percentage determination can also be applied when calculating the depreciation background in a given business unit. It is performed either according to accounting schedules or according to the requirements of an international body for development and publication of ISO standards, which requires compliance with the periodicity to be according to the quality assurance system introduced in the organization. The dynamics of technological advancement often precedes the standard introduced in the specifics. For this reason, each quality achieved becomes the standard for the next quality level [2].

When developing the criteria for selection of automated machinery and technological equipment, in addition to the factors determining the efficiency of its future operation, the costs that will be incurred according to the percentage of their obsolescence must be taken into account. In the conditions of financial and economic crisis an important factor is the maintenance of the technological equipment. Often in their quest to achieve low cost and high quality, organizations

use high-tech equipment that puts maximum load on them to recoup their investment faster. But the goal does not always justify the means, and instead of increasing efficiency, they increase the damage. The deterioration of the operational qualities of the equipment causes adverse consequences and damages to the organization, which prevent it from fulfilling its commitments to its customers. As a result of disturbed working parameters of the technological equipment the quality of the produced product or service deteriorates, the production or other activity is hindered, preconditions are created for occurrence of labor accidents or accidents, pollution of the working or environment. The consequences are serious and organizations would not allow the luxury of allowing them to occur. For this reason, the practice is to add the value of all these costs when determining the value of the product or service produced. To the calculations for return on investment, the depreciation rate of the equipment should be added, after which an adequate depreciation plan for its maintenance should be prepared [6]. As a solution in such difficult-to-predict situations, alternatives are often developed by turning off the problematic piece of equipment and replacing it with a manual or semi-automatic operation.

Taking into account the influence of the results of the automation, the most useful for drawing a conclusion was the detailed digital examination of the probable solutions on the return on investment and the negative factors from the over-exploitation. My personal opinion is that periodic concentration on risks helps to devise strategies to avoid adverse consequences of any kind.

From the analysis of the efficiency criteria we can conclude that by introducing automation, companies provide such production that is related to real human needs, uses such engineering knowledge and projects that ensure efficient use of all necessary resources, improves quality and increases their profits. .

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