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EVALUATION OF THE MACHINE MODERNITY IN THE MOTOR INDUSTRY

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ABSTRACT

Most manufacturing companies realize its technologies, implemented through concrete machinery parts. They differ in terms of importance, the relevance of their selection and the level of their modernity. The purpose of this article is to analyse the chosen production machine in terms of its modernity. The ABC technology method was chosen do this research. All parts of the machine were divided into three groups: parts of main subassembly A, parts of supportive subassembly B, parts of collateral subassembly C. Then each of these parts was evaluated in the Parker's five-point scale. From the conducted analysis it results that most parts of the research machine were manufactured with more complex technologies, requiring technical skills and knowledge or with unchanging technologies used for years. It means that the research machine is not a modern machine. Perhaps company managers should take a decision on the change of the machine for the newer one. This would allow for improvement of the technical parameters of the products, increase in production efficiency and reduction of the amount of nonconforming products. Therefore, it can be concluded that a properly selected and correctly applied parts of the subassemblies contribute to the improvement in quality of products and the efficiency of the machine.

Keywords: ABC technology method, machines, modernity, technology

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1. INTRODUCTION

Decision making is associated with the process of choosing the appropriate course of action. This often requires the selection of "the best" option from many possible solutions. The decision making is a difficult process because a person taking the decision is responsible for its future effects. Decisions of managers play an important role in the functioning of businesses, affect their state, processes occurring inside of them, and thus on its financial results. Therefore, decisions should be preceded by a thorough analysis of the situation (KAHNEMAN; TVERSKY, 2000; NIGHTINGALE, 2008).

One of the areas of enterprise management are decisions related to the owned technology and thus machinery park. What the quality of products will be, and thus whether the products will meet the requirements of customers, depend on the state of owned machinery park. Production technology and the state of the machinery park affect the company's competitiveness in the market, which is why company executives should take into account these elements when taking any decisions concerning the production process.

The state of the machine park, according to various sources (LOWE, 1998; KONSTANCIAK, 2012), can be evaluated for various aspects: effectiveness, productivity, energy consumption, material consumption, the use of human labor, but also modernity. Most of the features of the machine depend on its modernity. Therefore, any analysis of the state of the machine park, according to the author, should start exactly from the analysis of its modernity.

Most manufacturing companies realizes their technologies, implemented through concrete machinery parts. They differ in terms of importance, the relevance of their selection and the level of their modernity (PAULIČEK, et al., 2014; DZIUBA, JAROSSOVÁ, GOŁĘBIECKA, 2013).

Modernity of machines and devices can be classified, with use of the ABC technology method. The competitive advantage, expressed for example as the richness of the product assortment, can be used as a criterion for evaluation. This can be achieved thanks to the flexibility of devices that allow for variation in the type and quality of the product.

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The purpose of this article is to analyze the chosen production machine in terms of its modernity. The ABC technology method was chosen do this research.

This method is usually used in logistics to group company stocks, proper management of the stock levels, order preparation of the stock and precise determination of their levels, in production management to rationalize parts warehouse layout, improve the calculation results of the production order, the selection of operations in the technological processes, the choice of working position, in quality management to organize nonconformities or manufacturing errors in terms of frequency of occurrence (BORKOWSKI; SELEJDAK; SALAMON, 2006; KARDAS, 2010). However, its use for the evaluation of modernity of machines, according to the author, is also very useful.

Nevertheless, this is the first stage of the study on the evaluation of the chosen production machine. Subsequently, the author also plans to evaluate the effectiveness of this machine and its productivity. These studies as a whole will help the company managers to take decisions on the machine and to check if any change machinery park or technology used in enterprise is necessary.

2. MATERIAL AND METHODS

To evaluated modernity of machine and devices, the ABC technology method, described in following papers (KARDAS, 2010; BORKOWSKI; INGALDI, 2013; SELEJDAK; KONSTANCIAK; MIELCZAREK, 2010; BORKOWSKI; ULEWICZ, 2009; ROSAK-SZYROCKA; KONSTANCIAK; KNOP, 2010), was used. This method, called also Pareto-Lorenz method or the 80-20 rule, belongs to the techniques determining the actions aiming at improvement of the processes levels and quality characteristics of material goods and services. This analysis is based on the principle according to which, in each group several segments can be divided into marked with the letter A, which largely determine the results. For example in case of machines parts of main subassembly A appear at the beginning of system, at the end of the system parts of collateral subassembly C appear. In the middle of the system there are parts of supportive subassembly B.

Technologies of level A, also known as main technologies, are basic technologies, fundamental for business. They help to give special attributes to produced products.

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Technologies of level B are the enabling technologies of a general nature, available to all companies in a given industry. The company does not show interest in development, but benefits from such progress during the purchase of the machine.

Technologies of level C are supporting technology which are usually part of the overall business. These technologies are associated with its own machinery or equipment and are not subject to the innovative activity of the entity using it. User first of all cares for their proper maintenance, aiming to shorten their downtime and to eliminate their premature withdraw from use (INGALDI, 2013; PUSTĚJOVSKÁ; JURSOVÁ; BROŽOVÁ, 2012; LESTYÁNSZKA ŠKŮRKOVÁ; KUDIČOVÁ, 2011; FUTAS; PRIBULOVA, 2013).

The evaluations of individual parts of the machine can be made on the basis of Parker's five-point scale (KONSTANCIAK, 2012; BORKOWSKI; SELEJDAK; SALAMON, 2006; BORKOWSKI; ULEWICZ, 2009):

- Level 1 concerns of the simple machine parts manufactured with use of craft technologies.
- Level 2 concerns of the machine parts manufactured with unchanging technologies used for years.
- Level 3 concerns of the machine parts manufactured with more complex technologies, requiring technical skills and knowledge.
- Level 4 concerns of the machine parts manufactured with modern technologies.
- Level 5 concerns of the machine parts manufactured with the most modern, unique technologies, not known by other producers.

Parts of subassemblies of the machinery park and technology used by the company are extremely important for the quality of products. Machinery and devices equipped with modern parts, components not only work more efficiently, but also produce products with much higher quality.

The ABC technology method was used in the article to evaluate modernity of the riveting press. All parts of this machine were divided, in accordance with described method, into three groups: parts of main subassembly A, parts of supportive subassembly B, parts of collateral subassembly C. Then each of these

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parts was evaluated in the previously described Parker's five-point scale. The results were shown in tabular manner.

However, the division machinery on parts and their evaluation is not enough. The results are more visible and better understanding in the graphical form, which is why in the article these forms were used. This allows for easier interpretation of the results. With use of the histogram, a graphical interpretation of the results, which shows the differences in the allocated evaluations, was presented. With use of the pie charts, graphical summary of the percentage shares of individual levels for each part in every assembly was demonstrated. Final results of the ABC technology method for the entire research machine was shown in the traditional way: percentage shares of each level in the form of bars, and accumulated shares in the form of a linear function.

3. CHARACTERISTICS OF THE RESEARCH OBJECT

The company X is recognized as the most diversified automotive supplier in the world whose products and services include the development and production of parts, components, modules and systems, the development and installation of the entire car to the customer.

The company currently manufactures its products in three main groups of the assortment, namely group of the window lifters, group of the car locks, group of the break rods.

Main machines used in the production process are following:

- testing machines,
- screw plugs,
- riveting presses,
- welding machine.

In the article the riveting machine was analysed. It is pneumatic press. It is used to disc riveting, strips and brackets riveting. It is an economical, long life and robust construction, made in compliance with CE regulations. Its drive combines the pneumatics and hydraulics advantages. A part of such machine is well designed control system which ensures usability and variety of features.

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Due to the fact, that the manufacturer of the riveting press is an external company, from which author was not able to receive permission to use its name and detailed description of the machine, this information could not be mentioned in the article.

4. RESULTS AND DISCUSSION

The modernity research was conducted for the riveting machine. The most difficult stage of the study was to specify the different parts of the machine and their division into individual subassemblies. Evaluation of modernity level of individual parts of the research machine is presented in Table 1.

Table 1: Evaluation of the modernity of the parts of the riveting press (own study)

No	Parts of main subassembly A	Evaluation
A1	Screw plug to door bracket and strip bracket	3
A2	Setting of the brackets	2
A3	Detector of the door bracket presence	3
A4	Detector of the strip bracket presence	3
A5	Crush press	4
A6	Setting of the strip	4
A7	Detector of the strip in setting presence	3
A8	Screw plug to movable bracket	3
A9	Setting of kinked strip	2
A10	Detector of the strip and movable bracket presence	3
A11	Extrusion ram	2
A12	Pneumatic system	5
	Average	**3.08**
	Parts of supportive subassembly B	
B1	Main power transmission system	3
B2	Control Panel	3
B3	Assembly of air preparation	3
B4	Air lines	2
B5	Wires connectors	2
B6	Machine switch-key	2
B7	Safety barrier	3
B8	Power valve	2
B9	Button "START"	2
B10	Safety button	2
B11	Button "RESET" with special type of key	3
	Average	**2.45**
	Parts of collateral subassembly C	
C1	Green light CYCLE OK	1
C2	Red light CYCLE NOK	1
C3	Container for scraps "SCRAP BOX"	3
C4	Sensor of container for scraps use	3
C5	Shelves for containers with details	2
C6	Lighting	1
C7	Machine construction	3
C8	Foundation	2
	Average	**2.00**

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In Figure 1 graphical interpretation of modernity level of research machine was presented. In Figure 2 the structure of modernity level of the research machine taking individual subassembly into consideration was presented. In Figure 3 the final result of the ABC analysis is presented.

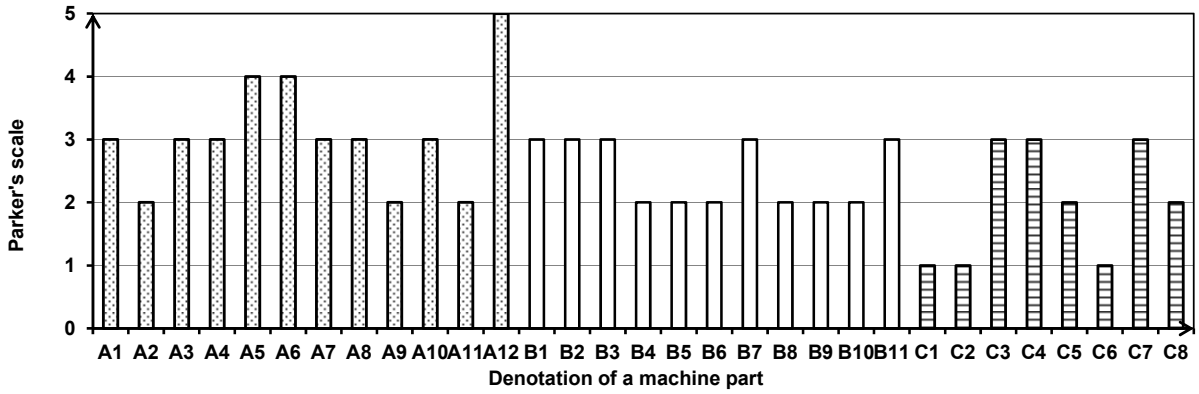

Figure 1: Modernity level of parts of the riveting press (own study)

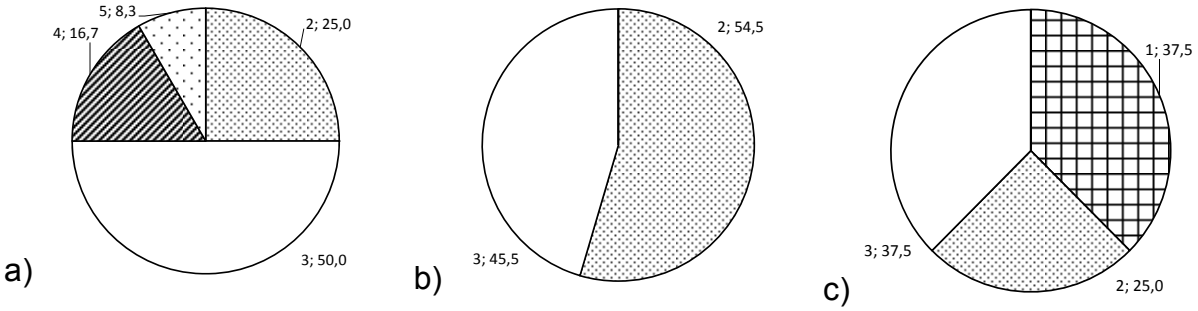

Figure 2: The modernity structure of subassemblies of the riveting press in: a) main subassembly, b) supportive subassembly, c) collateral subassembly (own study)

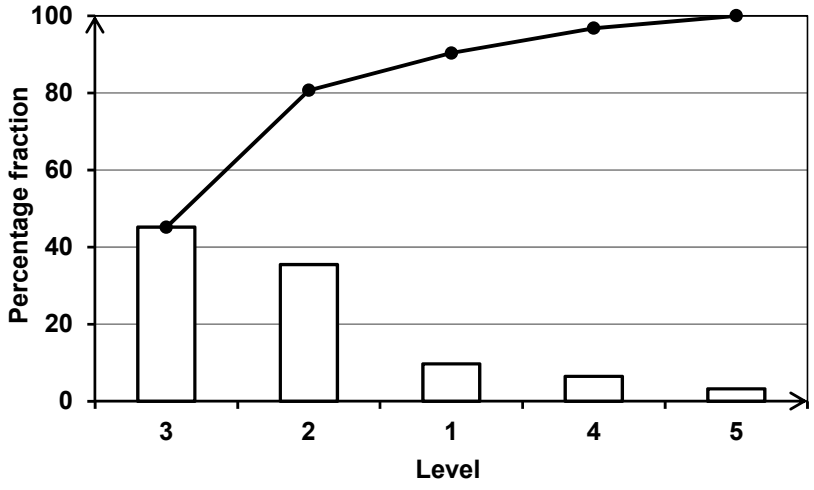

Figure 3: ABC analysis of the modernity level of the riveting press (own study)

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Individual parts of the riveting press, according to Table 1, Figure 1 and Figure 2 were classified in following way:

- Parts of main subassembly A: in 50% are on level 3, in 25% are on level 2, in over 16% are on level 4, and in over 8% on level 5. So 3 was the most often given evaluation (6 times). Pneumatic system was the highest evaluated part (level 5) while Setting of the brackets, Setting of kinked strip and Extrusion ram were the lowest evaluated (level 2) parts of the of main subassembly A. No part of this subassembly received evaluation 1. It should also be noted that the evaluations of parts of this subassembly were the most diverse. This group had the highest average evaluation (3.08). This means that the average part of the subassembly was manufactured with more complex technologies, requiring technical skills and knowledge.
- Parts of supportive subassembly B: in over 54% are on level 2 and in over 45% are on level 3. So 2 was the most often given evaluation (6 times). In case of subassembly B, the individual parts were evaluated only at 2-3, the average evaluation was 2.45, which means that parts of this subassembly were manufactured with more complex technologies, requiring technical skills and knowledge or with unchanging technologies used for years. Evaluations 1, 4, 5 has not been granted, which means small diversity in evaluations.
- Parts of collateral subassembly C: in over 37% are on level 1 and 3, in 25% are on level 2. There was no evaluation which was given the most often. It should be emphasized that some of these parts were evaluated on level 1, which means that they were manufactured with use of craft technologies. None of the parts received evaluation 4 and 5, which means small diversity in evaluations and also lack of modernity. Average evaluation of all subassembly was 2.0, which means that on average parts of this subassembly were manufactured with unchanging technologies used for years.

Average evaluation of the entire machine was 2.6, which means that, as in the case of the subassembly B, most of the parts were manufactured with more complex technologies, requiring technical skills and knowledge or with unchanging technologies used for years. It should be emphasized that the average evaluation of parts of subassembly A was higher than the average for the entire machine.

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Analysing Figure 3 it can be concluded that evaluation 3 was the most often given evaluation to individual parts of the research machine (over 45%). Evaluation 2 was next in the order (over 35%). Evaluations 1, 4, 5 had little impact on the overall evaluation of modernity of the research machine.

It means that the research machine is not modern. Perhaps company managers should think about changing this machine for newer one. This is the first condition, which tends to take such decision. This would allow for improvement of the technical parameters of the products and production process, increase in production efficiency and reduction of the amount of nonconforming products. Therefore, it can be concluded that a properly selected and correctly applied parts of the subassemblies contribute to the improvement in quality of products and the efficiency of the machine.

5. *CONCLUSIONS*

The main aim of the article was to evaluate technological modernity of the chosen machine used during the production process in the research company. The ABC method was used. This analysis is a part of the evaluation of the technological strategic position of the company.

The riveting press, which is used in the production process of the car window lifters, was analysed. From the conducted analysis it results that most parts of the research machine were manufactured with more complex technologies, requiring technical skills and knowledge or with unchanging technologies used for years.

The research machine is not modern, so managers should consider its change. It should be remembered that the more modern machine is and the same time the more modern its part are, the higher efficiency and productivity of its work are. Modernity also usually entails higher quality of products. Therefore, further research of the machine in terms of its efficiency and productivity of its work is planned.

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