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Assessment of the Technological Position of a Selected Enterprise in the Metallurgical Industry

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Abstract. A dynamic production market, in particular for the metallurgical industry, strongly influences the level of production efficiency, product quality, and mainly a company's position on the market and its competitiveness. This paper presents the results of research on the assessment of the technological position of a selected average company from the metallurgical industry in relation to development strategies. The analysis of a company's technological position has been made using the 3x3 matrix and Parker rating scale. The 3x3 matrix helped to determine an enterprise's technological position as well as factors that affect it. As follows from the presented research, an enterprise is located as “ordinary, average” both in terms of its technological possibilities and its position on the market. However, it was also possible to indicate the factors to which the company should pay special attention in order to strengthen their importance.

Introduction

According to various definitions, technology is the process of producing the necessary products and services, implemented in a hierarchical production system. It is important that all elements and connections are identified and have their order [1]. Available theoretical and practical knowledge [2] also play an important role for the implementation of technology. What is worth noticing, the functioning of enterprises in the 21st century is based on the constant pursuit of improvement and constant development [3]. The changing and dynamic external environment of each enterprise enforces the need to strive for improvement by using increasingly newer and innovative technologies [4,5]. Therefore, the scientific and technical resources (machines, devices, human capital, knowledge, experience, etc.) are becoming a very important competitive factor on the market [6–9]. The technological level of an enterprise determines the development of the organization, creates the possibility of strategy building, affects the efficiency and effectiveness of the enterprise, as well as determines the production volume, quality and unit costs [10,11]. The indicated competitiveness factors become particularly important when technology assessment is the basis for implementation or commercialization [12].

The assessment of technologies and potential technological possibilities is extremely important, because it allows the company to introduce changes aimed at production optimization, improvement of the products quality and increase of production capacity [1,12]. The results of technology assessment are also the basis for the implementation of modernization and reorganization of production processes. All activities related to the improvement of the technological potential of the company contribute to an increase in competitive advantage. Company's technological competitiveness depends primarily on the value of "applied research" and the competence of "development" teams, linking technology with the company's core

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business, time advantage over competition and financing potential [13]. The goal of a technology portfolio assessment is to maximize the expected profit with demand and technological uncertainty. Due to research on the assessment of a company's technological position, it is possible to increase its efficiency [14–16]. This is mainly to contribute to the risk assessment in two scenarios. Scenario 1: a company does not develop new technology because there is sufficient currently used - the risk that other companies in this industry will largely dominate the market due to the changing nature of industry (Industry 4.0). Scenario 2: a company will introduce new technology without proper preparation - the risk of a significant weakening of the position of an enterprise caused by the diversion of power to implement the technology for which it was not prepared [17].

Methodology

The 3x3 matrix, which determines the relationship between technological possibilities of the enterprise with its position on the market, has been used in the paper. This matrix was described in the previous works [18–20]. In the original matrix [20], the X-axis is represented by the technological possibilities and the Y-axis by the position on the market.

The 3x3 matrix consists of 9 fields, which correspond to the respective technological position of the companies and help to identify the future action in terms of technology. Therefore it can be used as an element defining the strategy of a company. The objective of each company is the field marked with number 1, that is "Focus on the revealed chance”. This is a field where both elements get high evaluations. So it can characterize a company as the one with a very good position on the market (competitive) and with high technological possibilities.

In the paper, also the 9-point Parker scale has been used. In the original version its scale is following: 1-3 means weak, 4-6 average, 7-9 strong influence [20]. But in the paper both positive and negative factors have been used so authors decided to change the interpretation of the scale for the following: 1-3 negative influence of the factor, 4-6 neutral (there is a factor but it has minimal influence or does not have it), 7-9 positive with regard to technological possibilities and position on the market. It allows for indicating the technological position of companies.

The research has been conducted in a chosen metallurgical enterprise. It is the enterprise operating on the market for about 50 years, producing various types of steel profiles for the European and global market. The first stage of the research determined the factors that well described the functioning of the enterprise. All these factors were divided into two groups: those that determine the technological capabilities of the enterprise and those that determine its position on the market. Those factors that did not match any of the groups were omitted. All these factors were evaluated on a scale of 1-9. 1 means negative influence, 5 means neutral influence, however the factor occurs, while 9 means positive influence. Then the average values for both groups of factors were calculated. These averages placed on the 3x3 matrix helped to determine the enterprise's technological position and determine the factors which affect it.

Results

The summary of factors which decide about technological possibilities of the research enterprise and factors deciding about its position on the market are presented in Table 1, while the 3x3 matrix and its technological position is presented in Figure 1.

From the analysis whose results are presented in Figure 1, it can be concluded that the research enterprise is located in the middle field of the 3x3 matrix, e.g. “Search for occasions”. This means that the enterprise is located as “ordinary, average” both in terms of its technological possibilities and its position on the market.

Table 1. List of factors for 3x3 matrix [own study]

Factors deciding about technological possibilities		Evaluation
1	Modernity of the production line	6
2	New technology of production	5
3	Time of changeovers	6
4	Synchronization between production operations	7
5	Repeatability of process	8
6	Use of SMED	7
7	5S methodology	6
8	Storage area	5
9	Modern means of transport	5
10	Flexibility of assortment	3
11	Quality of the products	7
12	Staff experience	5
13	A large number of young, qualified people on the labor market	2
14	Fluctuating prices of raw materials	4
	Average	**5.43**
Factors deciding about position in market		**Evaluation**
1	Regular customers	6
2	Opinion of the customers	7
3	New markets	4
4	Market demand	5
5	Product warranty	8
6	Advertisement	2
7	Competitive enterprises on the market	2
8	New competitors on the market	3
9	Substitutes on the market	3
10	Chinese products	1
11	Offers from foreign enterprises	6
12	Image of the enterprise	7
13	Low prices on the market	4
	Average	**4.46**

There are factors that should be emphasized because they have good influence on technological position of the research of the enterprise. When it comes to technological possibilities, the enterprise is able to repeat its processes (5) and obtains good synchronization between production operations (4). Both factors make the enterprise manufacture products of high quality (11). In the production process, the enterprise uses SMED (6), which has some influence on short production cycle. From the point of view of the position on the market, the enterprise gives a reasonable product warranty (5). This is of the factors that can have an influence on good opinion of the customers about the enterprise (2) and its image (12).

POSITION ON THE MARKET			
S	Buy the ready technology	Develop your technological potential	Focus on the revealed chance
A	Keep in the background	Search for occasions	Improve the marketing
W	Keep in the background	Discover the incidental market	Search for partners
	W	A	S
	TECHNOLOGICAL POSSIBILITIES		

Fig. 1. Technological position of the research enterprise [own study]

Summary

It results from the 3x3 matrix that the enterprise should think how to improve both variables. Between factors that affect technological possibilities, there are those independent of the enterprise, e.g. a large number of young, qualified people on the labor market (13) and fluctuating prices of raw materials (14). In the operating region there are not too many schools and universities that teach students about metallurgical industry, this kind of study is not popular at all among young people, who prefer easier subjects. Prices depend on their producers and situation on the market of materials. But the enterprise can have small impact on the flexibility of assortment (3). Maybe managers of the enterprise should think about introducing some more types of steel profiles in the assortment of the enterprise. The biggest problem when it comes to the position of the enterprise on the markets are Chinese products (10). This is a problem for enterprises from different industries. In the metallurgical industry it is especially bothersome, because enterprises from this industry do not have many possibilities to change their production profile and assortment. For the research enterprise there are many competitive enterprises on the market (7), not only those from China. Thus, it is difficult to acquire new customers and to have a big share of the market. There is also a problem with advertisement (6), but at the same time it is difficult to advertise any steel products and to conduct reasonable marketing campaign in order to convince customers in this way. Maybe it is a good idea to ask any professional marketing organization for help.

The method presented in this article can be useful in various areas, both industrial and related research, such as improving the surface of parts by ESD [21, 22] and testing the properties of the obtained surface layers [23, 24], including specific image analysis methods [25]. It may be also useful in mechanics [26, 27] and related quality management analysis [28] as well as in so high risk business as biotechnology [29, 30]. In heat transfer problems [31, 32], it should be also fruitful, especially with support from fuzzy approach [33].

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