CURRENT STATE AND FUTURE PERSPECTIVES OF STEEL PRODUCTION

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Abstract

The macroeconomic situation in the steel market has a large impact on the functioning of enterprises producing steel and steel-based products. Currently, global steel production continues to increase in 2017, seeing a rise of about 5.3 % over 2016. The absolute leader in steel production is China (about 49 % of global production), alongside countries of the European Union, Japan, India and USA. Overproduction is the biggest problem in the steel industry, which may affect the price level. Recently protectionism is a new threat which has appeared on the steel market. Furthermore, the philosophy of functioning of modern enterprises has also changed after the recent economic crisis. There is a growing need for new methods and tools to support business management. Also, the new concept of Industry 4.0 has attracted more and more attention all around the world, the main goal of which is to increase the competitive advantage of the enterprise. The assumptions of this concept are related to the development of the Internet of Things, cloud technology and big data. It offers great opportunities, but is also a big and difficult challenge. The purpose of the article is to identify the most important challenges that have the greatest impact on the management of enterprise in the steel industry and future perspectives. Particular attention was paid to the methods which increase the enterprise efficiency and effectiveness. Also, the main benefits and threats resulting from the introduction of the Industry 4.0 concept are identified.

Keywords: Global steel production, Industry 4.0, macroeconomic situation on the steel market, efficiency and effectiveness

1. INTRODUCTION

Many different factors influence companies operating in the steel industry. There are many methods which are commonly used to improve the effectiveness of processes [1-3]. Recently, macroeconomic changes in the steel industry have been very intense and constitute a key factor. Falling commodity prices are causing a strong downward pressure on steel prices. In addition, Asian countries are offering such low prices that many European companies are unable to compete with them. Industrial companies need a step change in terms of competitiveness, innovation and efficiency to gain competitive advantage on the market. Currently the business world is undergoing transformation. The steel industry is strongly influenced by the demand reported by steel buyers and the situation in the their industries. Almost half of the steel produced globally goes into buildings and infrastructure. In addition, steel is used in mechanical equipment and the automotive industry.

Steel overproduction is the biggest problem in the steel industry, which may affect the price level. Currently, global steel production increased in 2017 by about 5.3 % over 2016 [4]. Recently, a new threat appeared on the steel market - protectionism, which introduces important state-owned economies. In addition to macroeconomic factors, especially after the recent economic crisis, the philosophy of functioning of modern enterprises has also changed. There are new concepts which can have an big impact on companies from the

steel industry. The Industry 4.0 is the newest example. It was created in Germany, the main goal of which is to increase the competitive advantage of enterprises. The assumptions of this concept are related to the development of the Internet of Things, cloud technology and big data. It offers great opportunities, but it is also a big and difficult challenge. The question arises to what extent will it affect steel companies?

The circular economy also has a large impact on the steel market, which postulates primarily minimizing the environmental impact of the products created by such a selection of materials and design that will enable their re-use. As a result, the demand for steel can be reduced. The steel industry is characterized mainly by high energy consumption and significant emission of dust and gas pollution [5]. Hence, an important aspect in the steel chain is control and reduction of costs related to environmental protection.

The purpose of the article is to identify the most important challenges that have the greatest impact on the management of enterprise in steel industry and future perspectives. Particular attention was paid to the methods which increase the enterprise efficiency and effectiveness. Also, the main benefits and threats resulting from the introduction of the Industry 4.0 concept and circular economy are identified.

2. THE LARGEST STEEL PRODUCERS IN THE WORLD

The largest steel producer in the world is China. Its share in global production is almost half of global steel production (over 49 %). Among the rest, steel is mainly produced by the European Union countries, Japan, India, USA, South Korea, Russia, Turkey and Brazil, as shown in **Figure 1**.

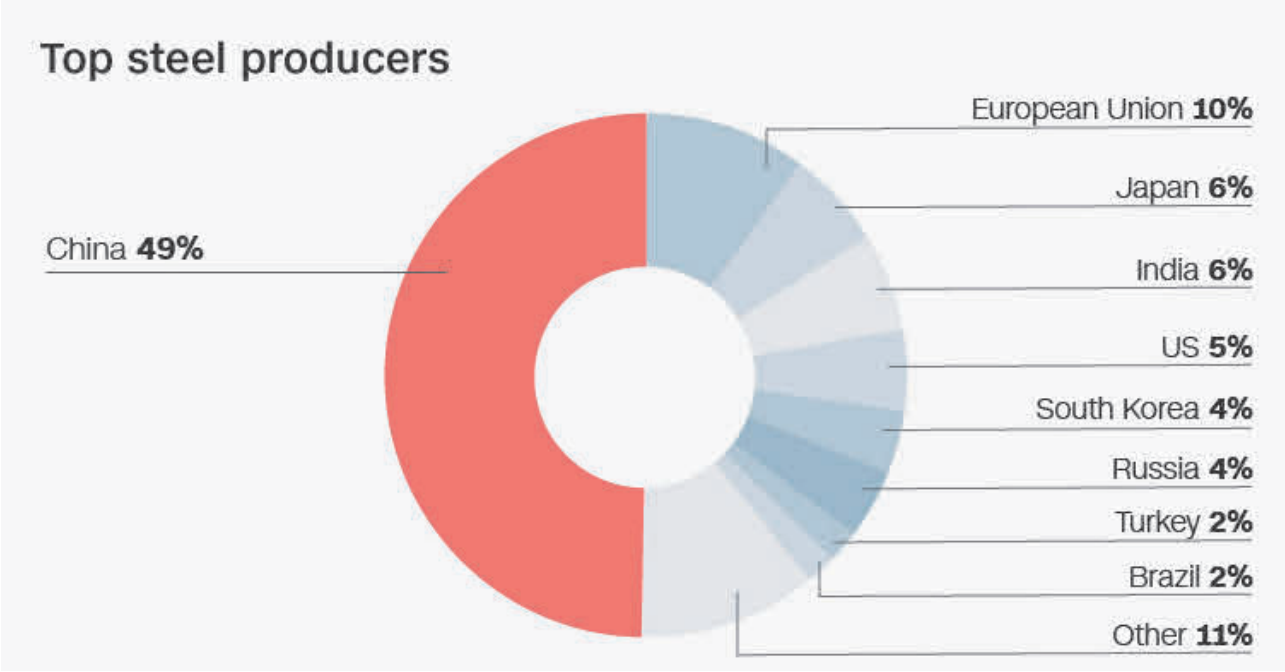

Figure 1 World's largest producers of steel [6]

Dynamic growth of crude steel production in China has been observed since the 1990s. China's competitive advantage on the steel market is huge in both production capacity and price. The following factors have contributed to such a large development of steel production [7,8]:

- growth in the automotive sector which causes an increase in demand for steel,
- government supports state-owned enterprises and secures long term production, and also helps to eliminate surplus capacity.

3. THE CURRENT SITUATION IN THE STEEL INDUSTRY IN THE GLOBAL MARKET AND TRENDS IN BUSINESS MANAGEMENT

The macroeconomic situation in the steel market has a significant impact on the functioning of enterprises producing steel and steel-based products. Main megatrends which have a big influence on the steel sector are at present [9]:

- global steel demand growth, caused rather by cyclical than structural factors,
- China deceleration,
- uncertainties related to the US economic policies and normalization of monetary policies in developed economies,
- continued geopolitical conflicts,
- financial market bubble and debt problem,
- rising trade protectionism,
- receding globalism, etc.

The steel industry's biggest problem is currently the overproduction of steel, which can significantly affect the price level. Global steel production increased in 2017 by 5.3 %. China, which is currently the leader in steel production, produced 831.7 million metric tons of crude steel in 2017, or 5.7 % more than in 2016. Japan, however, produced 104.7 million tons, or 0.1 % less than a year earlier. India produced 101.4 million tons of steel, or 6.2 % more than in 2016 [4].

Recently, a new threat has appeared on the steel market - protectionism. Although the analysis of data on the use of protectionist practices shows a smaller number of such cases every year, the threat of protectionism is growing, as the world's major economies are beginning to use such tools to protect their markets.

In addition to macroeconomic factors, after the recent economic crisis, the philosophy of functioning of modern enterprises is also changing. There is a growing need for new methods and tools that give the opportunity to gain a competitive advantage in the market. In particular, two new concepts can have a huge impact on steel companies: Industry 4.0 and Circular Economy.

The concept of Industry 4.0 was created in Germany in 2011 as a response to very strong competition from the Middle East. The Industry 4.0 concept seems to be an interesting proposition for steel sector and may increase their global competitiveness to a great extent. The main goal of this concept is to increase the competitive advantage of enterprises through the use of very modern, innovative solutions based on automation and technologies such as Internet of Things, cloud technology and big data.

The concept of Industry 4.0 implies that production is dominated by Internet-connected machines (so-called Internet of Things / IoT). The impact of man on the manufacturing process is greatly reduced. Machines dominate all aspects of product manufacturing. Machines associated with advanced software are beginning to collect production data in real-time and provide real-time error correction. Self-control of machines enables the design of automated supply chains, where delays are discovered and regulated in the near future. Connecting all machines to the internet ensures that the software that monitors the consumption of machines and equipment will immediately indicate the correct servicing time. The life cycle of products should be drastically shortened [10,11].

The very modern factories built according to Industry 4.0 can revolutionize the current approach to production. Such enterprises will create new supply chains with incomparably greater flexibility and efficiency. Therefore, there is a high probability that companies, which do not implement the assumptions of the Industry 4.0 concept will be automated or modern enough to belong to such chains in a few years. Hence, there is a strong pressure to introduce this concept in production practice and the need to create procedures for implementing the Industry 4.0 concept.

Industry 4.0 offers many development opportunities, but it is also a big and difficult challenge. As the own study shows the main barriers of implementing the assumptions of Industry 4.0 into production practice are:

- very high cost of production automation (e.g. modern machinery, specialized software, etc.),
- lack of capital (especially in medium enterprises),
- risk of too low return rate,
- risk of liquidity loss.

Particular attention should be paid to two key areas both technical and financial. Especially in the group of medium-sized enterprises, which have much smaller capital and have very limited possibilities of obtaining it, the implementation of this concept raises the risk of losing financial liquidity and too low rate of return. The key issue is therefore linking the stages of its implementation with the monitoring and control of financial and non-financial indicators in the most important areas in order to reduce the risk associated with the introduction of Industry 4.0.

The implementation of Industry 4.0 is a big challenge for industrial companies, which produce steel. They have to change their strategy completely and overcome many barriers. As the research indicates, changes must be made within four areas [12]:

- technical infrastructure - demand for machinery and equipment,
- automation of device operation and communication between them,
- employee competences - the skills of employees needed to control an automated manufacturing system [13],
- collaboration with other companies - building relationships and competencies with other companies that will allow joint manufacturing of products in the network of companies that make up the smart factories.

The second concept, which has a huge impact on the steel industry is circular economy. According to this concept the value of products and materials is maintained for as long as possible. Waste and use of resources are minimised. There is a rule applied that states that the product, after the end of its life, should be used again and creates further value. Such a rule brings benefits for economy and can lead to [14]:

- preserve resources (including especially some which are increasingly scarce, or subject to price fluctuation),
- save costs for European industries,
- unlock new business opportunities,
- build a new generation of innovative, resource-efficient European businesses.

The promotion of the circular economy principle and environmental challenges will lead to growing reuse of steel and could cause a lower steel intensity of GDP [4], but it is a significant risk for the steel industry. Circular Economy impact on steel demand can be [9]:

- lower steel intensity,
- longer life of steel containing goods,
- reduced demand for steel containing goods,
- lower scrap availability,
- increased scrap supply.

The presented changes bring about the need to introduce methods that will allow monitoring and controlling on a continuous basis, on the one hand, the implementation of technical, modern solutions, and on the other hand the costs, effectiveness of these implementations and the liquidity of the company. In addition, the steel industry should be aware of the control of costs related to environmental protection [15-17].

4. CONCLUSION

At present, steel is mainly produced in Asia, the European Union and North America. China is a leader in the production and export of steel. Almost half of steel production is owned by China. Steel is used in buildings and infrastructure, mechanical equipment and automotive manufacturing.

The analysis of the macro-economic situation of the steel industry presented in the article showed that the market conditions are currently changing very dynamically. It is a time of great challenges. There is receding globalism and rising trade protectionism. Countries such as the USA, Germany, Switzerland and the United Kingdom are beginning to protect their own steel markets. Such policies are causing increasing unpredictability on the market. Difficulties in estimating demand and prices can be particularly severe for enterprises.

There are chances for the development of European enterprises in the steel sector, but only if major changes are made to significantly improve their competitiveness and innovation. The concept of Industry 4.0 and circular economy creates great opportunities. However, the Industry 4.0 concept is a big challenge that requires huge changes in four main areas:

1) technical infrastructure - demand for machinery and equipment,
2) automation of device operation and communication between them,
3) employee competences - the skills of employees needed to control an automated manufacturing system,
4) collaboration with other companies.

According to research carried out by the authors of the article, the introduction of the Industry 4.0 concept into production practice is associated with high costs and high risk of loss of liquidity or insufficient return on investment. This problem is particularly visible in the group of medium-sized enterprises, which have considerably lower capital than large enterprises. Many of them are not able to create modern future factories themselves, so they must cooperate with other enterprises in order to create them together (types of industrial networks). Therefore, there is a need to create a system of indicators, thanks to which it is possible to constantly monitor and control the effectiveness of the implementation of the Industry 4.0 concept.

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