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Strategic Aspects of Development of the Bulgarian Metallurgical Industry

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Abstract: Over the last few years, the world economy has faced a number of problems and challenges that adversely affect its development. The Bulgarian economy and in particular the Bulgarian metallurgical industry, as open systems, are also subject to the negative impact of external and internal factors. The research is aimed at identifying and analysing the main issues and challenges faced by the Bulgarian metallurgical industry. The results of the study show a persistent adverse influence of some factors, both from the external and internal environment, which necessitates the need for metallurgical companies to develop and implement new strategies.

Key words: Bulgarian metallurgical industry, development, factors, challenges, strategy
JEL: L61, L71, O11, O14

Introduction

Metallurgy is one of the main structure-determining sectors of the Bulgarian economy. There has been evidence of its existence on the Bulgarian lands since the Stone-Copper Age. Until the beginning of the 1950s however, "neither the Bulgarian state nor private capital was able to build at least one large-scale, contemporary metallurgical enterprise" (Аврамов и др., 1996, с. 37), and in Bulgaria "there is limited extraction of mineral and energy raw materials and small metallurgical enterprises" (Вутов и др., 2015, с. 24). Later, the discovery and exploration of ore deposits economically justified the construction of metallurgical companies, modern for their time and relatively large for the scale of the country, whose production, in addition to fully satisfying the needs of the Bulgarian economy for copper, lead and zinc and stimulating its development, is also export oriented. Since the mid-1990s, on the basis of the already built capacities, the construction of modern metallurgical enterprises with both local and foreign capital began. At the same time, unprofitable metallurgical companies were closed. Gold mining also started in one of the richest gold deposits in Europe – Chelopech.

Metals, alloys and their products are important resources along the added-value chain in almost all sectors of the economy and

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in the household. Copper is the main raw material of the global transition to low carbon energy. The World Bank report, "Minerals for Climate Action: "The Mineral Intensity of the Clean Energy Transition", states that long-term demand for metals will increase dramatically – global demand for aluminium and silver is expected to grow by more than 300%, and zinc, steel, lead and especially copper – by over 200% by 2050 (World Bank). The restructuring economy and the need for business digitalisation strengthen their role even more and place ever higher demands on their quality characteristics. Given the high rate of recycling with a low carbon footprint and the long life cycle of metals, the circular economy and efficient use of resources is a priority in the "green" policies of the European Union (EU) and the European Green Deal (EGD).

Although well developed, relatively modern, competitive on international markets, especially in the non-ferrous metallurgy sector, and with good achievements to date, the Bulgarian metallurgical industry faces a number of problems and challenges, some of which are of a long-term nature. The improvement of technologies and the transfer of innovations in metallurgical production and its digitalisation impose increasingly higher requirements on the qualifications of employees working in the industry. As a strategic industry, metallurgy is associated with significant risks due to high production intensity, strong dependence on raw material suppliers, energy prices, import of cheap raw materials, high environmental protection costs, strict rules on occupational safety, requirements for digitalisation of business etc.

The main objective of this study is to assess the state and to identify and evaluate the main problems and challenges faced by the Bulgarian metallurgical industry. The thesis being defended is that the problems and challenges faced by Bulgarian metallurgy require the development of new strategies at all levels – company, branch/sector, as well as state level, since this industry is one of the drivers of growth of the Bulgarian economy. This research fills a thematic gap in the Bulgarian specialised scientific periodicals and can serve in conducting future studies in the field of the development of metallurgical industry.

Literature review

In the book "Металургията на България" Аврамов и др. (1996) traced the origin and development of Bulgarian metallurgy from antiquity to the mid-1990s. Its continuation is the monograph "Минало, настояще, бъдеще", which examined the metallurgical industry and its development until 2015 (Вутов и др., 2015). The review and subsequent analysis of periodicals in Bulgaria show that the number of publications on the current topic is very limited. Even in Bulgaria's only magazine specialised in the field of metallurgy (Journal of Chemical Technology and Metallurgy), in which dozens of papers are published annually, those dealing with economic, organisational or management problems, and not only of the metallurgical industry, are very few. Their subject matter is more or less close to the topic of the metallurgical industry and its development. Kondev, Tenchev and Vasileva (2014) examined the competitiveness of the chemical and metallurgical industry, paying special attention to the open innovation model. Karev (2020) made an economically justified proposal for optimising the production costs of enterprises producing concentrate for the metallurgical industry. Borisov, Stefanov and Stoyanov (2014) presented an algorithm for minimising metallurgical production waste.

The metallurgical industry, regardless of the sector (ferrous or non-ferrous metallurgy), is a highly concentrated industry of the Bulgarian economy, with an oligopolistic structure. Some of the leading companies in

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ferrous and especially non-ferrous metallurgy can largely represent the sector or sub-sector itself. Such, for example, are "Aurubis Bulgaria" (one of the largest companies for the production of copper in South-Eastern Europe), KCM (the largest company for the production of lead and zinc in South-Eastern Europe), "Dundee Precious Metals" (gold mining). Милушева (2018) directed her research interest to one of the giants in non-ferrous metallurgy and in the Bulgarian economy as a whole – "Aurubis Bulgaria". She conducted an empirical study related to the growth of this company, and the results of the study allowed her to draw a number of conclusions and generalisations.

Foreign publications on the current topic are quite diverse. Various problems (general and particular) of the development of both the world metallurgical industry and national industries are treated. Considering the increasing challenges for managers in the condition of recession, Bakalarczyk and Gradzki (2012) made an attempt to diagnose the business risk of the Polish steel industry in the conditions of an economic downturn.

The growing attention to environmental pollution and the harmful impact on human health, as well as the role of metallurgical enterprises in this process, has been considered in a number of papers. Ilutiu-Varvara and Aciu (2022) investigate the chemical and mineralogical composition of metallurgical waste deposited at the Padiga slag dump (Alba County, Romania), and Cîrţînă and Traistă (2014) considered the technological problems of Romanian metallurgy and noted that on a global scale about 80% of waste steel is recovered, and in Romania – a maximum of 48%. The authors note that the proper management of metallurgical waste will lead to environmental protection, saving of natural resources and sustainability of the steel industry. The metallurgical industry, according to Lis and Nowacki (2022), is responsible for a large amount of waste that has a negative impact on the environment and human health, and therefore any research into waste management, including by metallurgical companies, is justified. The main aim of the study by Ferreira et al. (2010) was to determine whether noise in the metallurgical industry in Agueda (Portugal) poses a health risk to workers. Since in the workplaces in the metallurgical industry the activities are carried out under conditions harmful to health, Spilka (2021) assesses professional risk and indicates corrective actions to increase occupational safety. Carrying out an economic and ecological analysis, Di Maria et al. (2022) evaluate the energy and resource efficiency for recovery of metallurgical residues.

People, especially decision makers, are one of the most important success factors in all areas of human activity. The empirical study by Sikhimbayev et al. (2019) aimed to establish readiness for change among managers from the mining and metallurgical industries of Kazakhstan. The study of Kostalova, Bednarikova and Patak (2018) was also in the field of human resources in metallurgical companies. By interviewing HR managers of metallurgical companies in the Czech Republic, the authors aim to identify ways of training project managers, project team members and senior management members.

The topics of sustainable development and corporate social responsibility of metallurgical enterprises have been considered in a number of studies. Lenort et al. (2020) examine opportunities for the metallurgical and mining industries to create value for both their business and society through the prism of the Sustainable Development Goals (SDGs). In their study, Lenort et al. (2017) identified and categorised the most frequently used sustainable key performance indicators (KPIs) and analysed the methods for their evaluation in the metallurgical industry. Similar was the

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study by Stas et al. (2017), in which sustainability was considered as an approach to achieve long-term success of the steel industry. Sun, Pan and Zhi (2015) analysed the existing corporate social responsibility (CSR) problems of Chinese metallurgical enterprises and proposed their solutions. The results of Orekhova's (2017) study revealed the unsustainability of the economic growth of the Russian metallurgical complex. According to Bakalarczyk, Pomykalski and Samolejova (2014), modernly managed metallurgical companies in Poland turned to innovation management in search of vital components of effective strategies. Necsulescu, Necsulescu and Marcu (2009) examined the difficulties of the Romanian metallurgical industry, the source of which were the economic crisis and unfair competition coming from the unregulated markets of Turkey and Ukraine.

Methodology

The research is based on a review of the available (Bulgarian and foreign) literature on the subject (books, monographs, articles, proceedings of held scientific forums, etc.). A number of documents were studied, incl. strategic, relevant to the research (National Development Programme BULGARIA 2030, Action Plan Adopted for Implementation of BULGARIA 2030 National Development Programme for 2022-2024 Period, the World Bank report "Minerals for Climate Action: "The Mineral Intensity of the Clean Energy Transition", European Green Deal, etc.). The membership of almost all metallurgical companies in our country in the Bugarian Association of the Metallurgical Industry (BAMI) allowed to study production, products, investments, policies, markets, etc. of the leading metallurgical companies. The statistical data necessary for the purpose of the research were obtained from Eurostat, World Bank, the National Statistical Institute (NSI), The observatory of economic complexity, the Yearbooks of BAMI and the German-Bulgarian Chamber of Industry and Commerce (GBCIC), etc. In the course of the study, research approaches and methods were applied, such as historical approach, content analysis, comparative analysis, method of induction and deduction, analysis and synthesis, etc.

Results and discussion

Bulgarian Metallurgical Industry Nowadays

State and achievements

Since the beginning of 2021, the economies in the EU have marked growth and resumption of production in key sectors. This has an impact not only on the Bulgarian economy, but also on our export-oriented industry, which is primarily intended for the EU markets. The overall growth of both industrial output and GDP is higher than other EU countries. After the National Statistical Institute (NSI) reported a GDP decline of 4.4% in 2020, for 2021 our country recorded a growth of 4.2% – one of the highest in Europe. According to the preliminary data of the NSI for 2021, Bulgaria's GDP at current prices is BGN 139 012 million, compared to BGN 129 553 million in 2020. GDP per person employed is BGN 31 022 – a growth of 103.4% compared to 2020. The increase in the overall productivity of the Bulgarian economy is mainly due to the growth in industrial production. Its share in the annual GDP is growing – from 18.4% in 2019 and 18.75% in 2020, in 2021 it reaches 19.20% (Figure 1).

The value added per employee in metallurgy remains high – more than twice the average for the manufacturing industry, and for non-ferrous metallurgy this indicator is four times higher than the industry average (Yearbook of BAMI, 2022). This is as a result of investments made in new technologies and products with high added value, achieving high productivity and efficiency.

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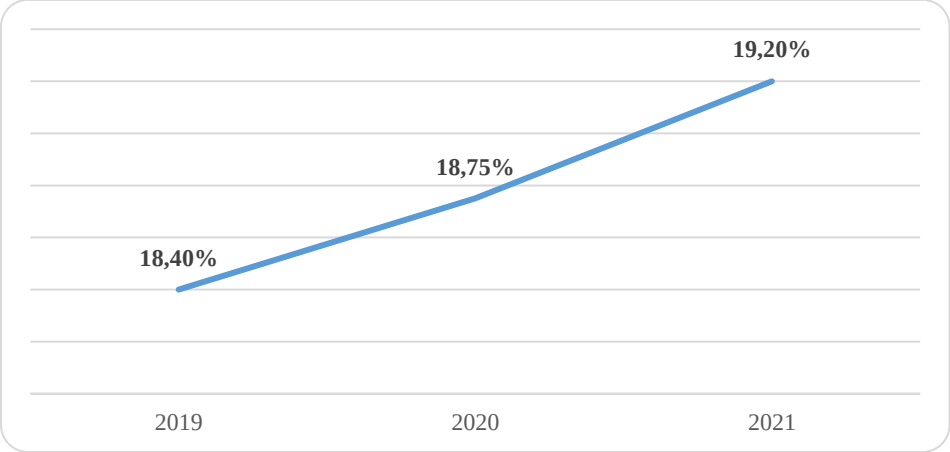

Source: NSI

Figure 1: Share of the industry in GDP for the period 2019 – 2021 in %

The Bulgarian economy has an open nature and a large part of the goods produced in the country are intended for export. As a member of the EU, Bulgarian exports are mainly realised on the European markets, as well as on those of the countries of the region. According to data of the National Statistical Institute, goods worth BGN 68.2 billion are exported in 2021, of which 66% are intended for EU markets. In recent years, metals have made a high contribution to export indicators, with their relative share reaching 15% (Table 1). In 2020, Bulgaria was the 16th largest exporter of refined copper in the world with exports worth $1.2 billion, with refined copper being Bulgaria's most exported product (OECa). In the same year, Bulgaria was the largest exporter of iron pyrites in the world (OECb), and in terms of exports of raw copper the country was in fourth place (OECc). According to the data of the companies producing metallurgical products and the official statistics of NSI, the export to the EU markets and to third countries is from 70% to over 90% of the annual production of the companies in the branch (NSI). This is the result of the companies' good competitiveness, based on the large-scale investments made in technologies and new productions. Non-ferrous metallurgy, which has a high contribution to the indicators of the Bulgarian processing industry, has been developing particularly successfully and sustainably in the last few years. It is also an important factor in the production of non-ferrous metals within the EU.

Table 1: Foreign trade – exports by product groups "raw materials and materials", million euros

Groups of goods	2019	2020	2021
Raw materials and materials, incl.	**11668.6**	**11644.0**	**15030.7**
• *Cast iron, iron and steel*	*608.1*	*534.0*	*976.2*
• *Non-ferrous metals*	*2323.1*	*2555.2*	*3202.9*
Total exports of the country	***29856***	***27969***	***34866.9***

Source: NSI

According to data available to Eurostat, in economic activity 24 "Production of basic metals" in 2020, production worth 290 billion euros was produced in Europe. For comparison, in 2019, the output was 50 billion more (a decrease of 15% in 2020). Eurostat data show that, with the exception of Bulgaria, all other countries in 2020 reported a decline

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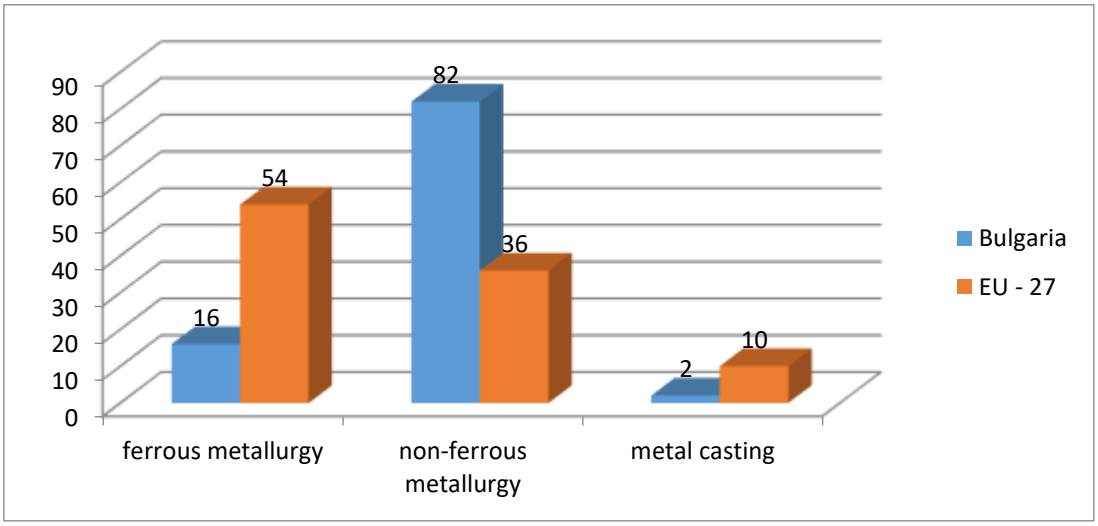
in the metallurgical industry. Only the Bulgarian non-ferrous metallurgy enterprises increased their production output by 271 million euros and recorded a growth of 5%. In the steel sector, the situation is similar to that in other countries – the liquid steel produced in our country was 82 thousand tons less (a decrease of 14%). In 2020, Bulgaria produced metallurgical output worth EUR 5 243 million (a growth of 5% and a share of 1.8%, compared to a 1.5% share for 2019). With this production volume, our country occupies 12th place in the annual ranking of the EU member states. After the closure of the largest steel plant in Bulgaria, the ratio between the ferrous and non-ferrous metallurgy sectors has changed. Now non-ferrous metallurgy has a higher relative share and this difference is gradually increasing (Table 2).

Table 2: Output values and shares of separate industries in 2020.

Production	Produced output, million euros	Share, %
Ferrous metallurgy	840	16 %
Non-ferrous metallurgy	4 311	82 %
Casting of metals	92	2 %

Source: BAMI

The share of separate productions in the EU-27 and Bulgaria for 2020 according to Eurostat data from 18 May 2022 is shown in Figure 2. In Bulgaria, non-ferrous output is dominant with a share of 82%, while within the EU, ferrous metallurgy is dominant with 54%.



Source: Eurostat

Figure 2: Share of production in metallurgy in EU-27 and Bulgaria for 2020 in %

In 2021, the steel production of the EU and of Bulgaria showed a growth of 15% and 13.3%, respectively, but the share of separate productions was preserved. The metallurgical industry in the country is characterised by a high degree of specialisation in the production of basic non-ferrous metals – lead, zinc and copper and of rolled products and products from aluminium, copper and their alloys. While in terms of the total volume of produced metals (ferrous and non-ferrous) Bulgaria occupies 12th place among the EU countries, in the ranking for non-ferrous metals our country is in the 6th place, with production for 4 311 million euros and a share of 4.2 %.

Issues and challenges

In 2021, the Bulgarian economy gradually recovered after the negative impact of external

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factors, such as the Covid 19 pandemic, disruptions in supply chains, etc. The GDP growth and the resumption of various industries cannot compensate for the deterioration of the country's demographic indicators in recent decades. An aging population and labour migration are the main reasons for the shortage of personnel – from workers to highly qualified specialists. Companies in the steel industry are also having trouble finding qualified employees. Young people in our country associate the profession of metallurgist with hard work that is harmful to their health and do not see good opportunities for career development, despite the high salaries in the industry. For 2021, the average monthly salary in non-ferrous metallurgy is over 53% higher than the average monthly salary for the country and nearly 90% higher than that in the manufacturing industry (NSI, BAMI). The difficulties that employers face in providing qualified specialists, the insufficient quality of academic and especially professional education, the shortage of qualified labour, leading to increasing labour costs, are also evident from the survey conducted by the GBCIC (Yearbook of GBCIC, 2021).

The metallurgical industry is characterised by high environmental protection costs and strict occupational safety and health rules. Metallurgical production is the second most important (after energy) source of environmental pollution and all its components (soil, air and water). Most of the metallurgical enterprises are located in or in close proximity to inhabited areas, and some of them even on fertile agricultural lands. The pressure of non-governmental environmental protection organisations and the observance of increasingly strict environmental standards are a serious challenge for metallurgical enterprises and require serious investments in environmentally and human health-friendly production technologies. In view of the increased demand for metals worldwide, an increase in production in Bulgarian metallurgical enterprises is expected, which will further exacerbate the problem of high environmental protection expenditure.

The higher energy intensity than the EU average is characteristic of the Bulgarian economy and industry. The metallurgical industry, in addition to energy intensity, is also characterised by extremely high material intensity, which determines its strong dependence on the prices of energy carriers, the quality and prices of raw materials, water for technological needs, the offered transport services. This problem directly corresponds to sub-priority 4.1 of the National Development Programme BULGARIA 2030, the aim of which is to reduce resource intensity and increase the efficiency of the materials used. The clearly emerging global trend of decreasing the average content of metals in mined ores and the high material intensity of the metallurgical industry require the utilisation of production residues and an increase in their share in the raw material balance and a wider application of circular models in order to increase the resource and environmental efficiency. The repeated increase in electricity prices for non-household consumers, as well as the jump in natural gas prices, have an extremely negative impact on the industry and make them unaffordable for companies with high energy consumption. Rising energy prices since the second half of 2021 have led to declines in steel, lead and zinc production and financial losses, and metal casting plants operate at low capacity utilisation. Mechanisms for long-term supplies of energy carriers at affordable prices are being activated in a number of European countries. Despite government intervention and support for business, Bulgarian companies continue to suffer financial losses and increased production costs result in their competitiveness. An additional issue that reflects on the competitiveness of the metallurgical industry on international markets is the unfair

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competition coming from countries where EU legislation is not applied.

The implementation of sub-priority 3.1 of the National Development Programme BULGARIA 2030, the main objective of which is to overcome the lag in the digitisation of business, is also a challenge for metallurgical companies. This requires increasing the digital competence of the personnel of metallurgical companies and the possibilities of using digital technologies, which in turn will further increase their costs.

Undoubtedly, global demand for metals will increase. Green government policies, as well as the digitalisation of the business and the public sector, will accelerate this process and will create new opportunities for the development of our reformed metallurgical industry. However, this requires new strategic approaches and more investments to build production facilities, to innovate, to increase the qualifications of personnel, etc. Some of the companies are already looking for opportunities for alternative fuels and building their own power generation facilities. For instance, "Aurubis Bulgaria" launched a project worth 2.8 million euros to build a photovoltaic park with a capacity of 10 megawatts, which would satisfy part of the company's electricity consumption.

In recent years, companies from the sector have invested hundreds of millions of euros in various projects, not only for increasing the volume of production, renewal and modernisation of capacities and technologies, maintenance of facilities, infrastructure projects, projects for energy efficiency and protection of the negative impact on the environment, but also in projects for training and qualification of employees, improving the working environment and creating safe and healthy working conditions. The activity of all companies from this sector is also associated with large investments in the field of digitisation in response to the restructuring economy and significant funds for CSR activities.

Conclusion

Despite the significant place and role of the metallurgical industry in the Bulgarian economy, as well as its indisputable achievements nowadays, the companies in the sector face a number of problems – the high prices of energy carriers, the shortage of qualified labour, disruption of supply chains, the low degree of digitisation of business, the high cost of compliance with environmental standards, protests by environmental organisations, etc. A large part of these problems have a long-term nature, which requires, both at the industry/sector level and at the micro level, to work on strategies through which the metallurgical industry can adapt to the new realities and respond adequately to the challenges. The aims of the circular economy must become a national priority, and the state, through its instruments, must create a favourable environment and support the industry if necessary.

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