

Opportunities and Challenges in Modeling an Environmental Management System

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Abstract. The business ecosystem provides full integration of economic and environmental objectives. Every company, including those from the Bulgarian mining industry, implements specific actions, mechanisms, innovations for environmental management. The aim of the present study is to analyse the relationship between the economic and non-economic priorities of enterprises of the mining industry, especially now in the context of solving the global problem of transformation towards sustainable development. The following research tasks have to be settled for reaching the above-mentioned goal: 1. to analyze the influence of modern technologies, the remote control of machines underground, including remote control and self-learning drones in underground mines on the optimization and improvement of work processes and the protection of a cleaner environment; 2. to focus on some relevant aspects of green transformation of the mining industry, incl. in the development of environmental, social and new management models as a factor for successful business; 3. to research the impact of the initiated cycle of interest rate tightening on the implementation of the planned activities for environmental management of the mining industry. In the course of the study shall be justified the thesis that the future of the mining industry in Bulgaria is digital, green and sustainable. The methodology of structured interview was used. The sample was formed by the method of random non-recurrent selection. For the purposes of the research, we have carried out analysis of the whole assessment of the favourable opportunities and potential risks, as well as the strengths and weaknesses of the new model for an environmental management system. The results of the research are expressed in establishing the trend for digitalization and innovation, tracking the importance of environmental management and protection.

Keywords: Bulgarian mining industry, business ecosystem, environmental management, natural resources.

I. INTRODUCTION

One of the objectives of the European environment policy is to encourage all types of businesses to reduce their harmful impact on the environment. Caring for nature and minimizing pollution and damage to the environment also applies to the mining industry. The pursuit of a full integration of economic and environmental goals by mining enterprises requires the analysis: *business-environment-technology-future*. The relevance of the research is determined by the complex circumstances in which the enterprises of the mining industry operate: 1) the consequences of the COVID-19 pandemic; 2) the war in Ukraine; 3) interest rates and inflation growth; 4) the bankruptcy of the American banks “Silicon Valley Bank” and “Signature Bank”, which may affect Europe and their complex negative impact on the green economy, digitization, innovation in the context of the mining industry.

Modern Monetary Policy versus Green Transition

According to the Keynesian theory of money, monetary policy does not have an important impact on investment and consumption, resp. on economic activity.

M. Friedman believes that any change in the value of money does not lead to a change in the utility of wealth, but only to a change in its monetary value [1].

The goals of government – boost production or stagnation – determine how money affects the economy (monetary expansion or restrictive monetary policy). The Central bank is the institution that should coordinate, direct and control monetary effects, while the regulated increase or decrease of money in circulation is inextricably linked to unemployment and inflation.

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The early 1980s remain in economic history with a special focus on the fight against inflation. It was treated as the greatest evil of the economy [2].

Another evil was also born during this period. It has consequences for the planet and humanity - climate change and its acute threat to civilization. The period of awareness was long and difficult, but world leaders are on the right way to reach a global agreement. Now the world is beginning to adapt to the new reality of sustainable transformations of the 21st century [3]. This definitely applies to the mining industry as well. The expansion of mining business is impossible without a quick response for adequate management of natural resources, the implementation of an environmental management system, investment in nature-friendly technologies, investment in machinery that protects the environment, investment in intelligent mining of ores and minerals.

This means that at the moment there are threats to nature and the planet on the one hand, on the other – the need for investments in smart technologies for mining and on the third – the danger of the collapse of the sector due to emerging problems with investments in the industry, interest rates, inflation, bank failures in the USA and its impact on European business.

II. MATERIALS AND METHODS

The structure in the pursuit of a comprehensive and reliable study of opportunities and challenges in modeling an environmental management system, in the course of the study we refer to the Eco-management and Audit Scheme (EMAS). It was created by Regulation No. 1221/2009 (also known as EMAS III) and is directly applicable in all industries (including the mining industry) and all types of organizations in the public and private sectors that seek to improve their environmental performance. Special attention is paid to the key certificate ISO 14001:2015 (previously ISO 14001:2004). Its purpose is to help enterprises of the mining industry to achieve the intended outcomes of their environmental management system, which provide value for the environment, the organization itself and interested parties.

We have used environmental strategy papers in 1) Europe as follows: The UN 2030 Agenda, The European Green Deal: A New Growth Strategy to make the EU a fair, inclusive and prosperous society with a modern, knowledge-based, resource efficient and competitive economy; annual sustainable growth strategy for 2020; The Green Deal Investment Plan: the EU's strategy to promote sustainable public-private finance over the next decade; A strong social Europe for fair changes; ESG Standards; etc. and in 2) Bulgaria as follows: National strategy for the environment and an action plan for it, Strategy for transition to a circular economy of the Republic of Bulgaria (2022-2027 Category: Environment), National program for protection, sustainable use and restoration of functions of soils (2020-2030), the Environmental Protection Act, etc.

Innovative and digital solutions for facilitating planned and managerial activity, technological development of enterprises, intelligent and sustainable industry in the conditions of intensive business challenges have been

discussed in works by various authors [4] – [12], etc. They have been presented at scientific forums and meetings; nevertheless, no complete scientific research even more in the context of the mining industry has been conducted on them. All ideas and conclusions expressed in those works establish the basis for the completion of the established tasks of this research. All ideas and conclusions in the developments are a good basis for implementation of the assigned tasks of the present research.

A research was made by the help of the structured interview methodology amongst enterprises of the mining industry in Europe, at which is provided full integration of economic and environmental objectives, using the method of random sampling without replacement. The methods of comparative analysis, induction, deduction, Crosstabs and SWOT Analysis were also used.

III. RESULTS AND DISCUSSION

A. Concept of digitalization and environmental protection in mining industry

Digitization of working processes and investments in modern technologies successfully implemented in open and underground mines create conveniences, minimize costs and time and keep the environment clean. In this way, business value is added and growth is achieved to transform the mining industry into a fair and inclusive business with modern, knowledge-based, resource-efficient and competitive management.

The improvement of technology finds expression in safe, fast and environmentally friendly solutions, of which more than ever the mining industry feels a gigantic need. The acquisition and implementation of modern technologies and digitalization in mines, remote control of underground machines, tele-management and self-learning drones in underground mines are the right direction for optimization of working processes. At the same time, these are the tools that positively affect the protection of a cleaner environment during the working process [13]. Are enterprises of the mining industry ready for major investments to care for nature? Because these technologies are expensive. Do they have the cash they need or they have to borrow from the banks at such high interest rates at the moment? Analysis of the attitudes and the perspectives of the stakeholders was carried out.

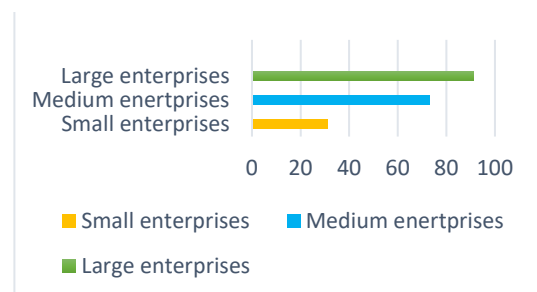


Fig. 1. Categories of businesses versus opportunities of achieving eco-efficiency solutions (in percentage).

The sample was formed from enterprises – open and underground mines in Europe by the method of random non-recurrent selection. Considering the mining industry,

there are no micro-sized enterprises in the sample. Period of the survey January 2018-January 2023. The results have found expression in (Fig. 1).

98% of respondents believe that digitization of working processes and investments in modern technologies implemented in open and underground mines create convenience, minimize costs and time while keeping the environment clean. More than 90% of respondents believe that this is the only way to add business value and achieve growth to transform the mining industry into a fair and inclusive business that is modern, knowledge-based, resource-efficient and competitive management. At the same time, this is mainly within the power of medium-sized and especially large enterprises of the mining industry.

B. The role of green transformation in the context of the mining industry – ecological, social and new management models, as a factor for successful business.

Our research aimed to identify the key components of the Environmental Management System by the example of [14]. The results are as follows (Fig. 2): key components for building an environmental management system are Organizational structure (OS), Target device (TD), Planning technologies (PT), Experience of implementation of environmental policies and solutions (E-EPS), Resource provisioning (RP). For the purposes of our study, the results are presented as a percentage.

As a result of our research, we can also propose a model for an environmental management system as follows (Fig. 3). Due to the fact that the Environmental management system cannot exist in isolation from the work processes and the external environment, the two-way connections that would be more often observed among the respondents are visualized. More than 75% of respondents highlight the key role of the leader in building and implementing this system. This shows that the role of the leader is as important as funds, investments, reliable accounting system, planning and budgeting.

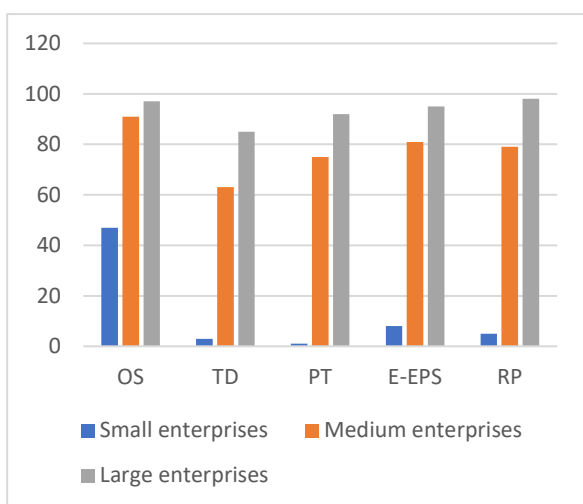


Fig. 2. The relationship “Importance of individual components- different types of enterprises”.

In a complex situation, a very important process is about to occur in the European Union – the sustainable way of doing business will be imposed in a short period of time through ESG standards. Every company (including from the mining industry) must adapt its business models in accordance with the new standards for environmental and social impact and good corporate governance. Otherwise, it will suffer fines, have difficulty accessing bank financing and experience in raising capital through the stock exchange [15].

Fragmentary SWOT-analysis of the enterprises of the mining industry, that has a functioning environmental management system, indicate an objective picture of its implementation. The results have found expression in assessment of the perspectives of the enterprises of the mining industry by performing a fragmentary SWOT analysis. (Table 1)

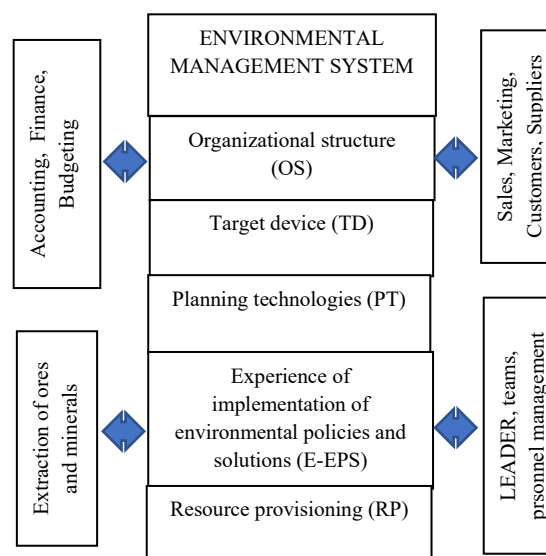


Fig. 3. Model of environmental management system – connections and dependencies with the internal and external world of the enterprise of the mining industry.

TABLE 1 FRAGMENTARY SWOT ANALYSIS

External Factors	
OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> ▪ easier access to new markets; ▪ better public image increased; ▪ increased opportunities to invest in innovative products. 	<ul style="list-style-type: none"> ▪ risk of losing markets in developing countries; ▪ risk of additional tightening of regulatory conditions in the future.
Internal Factors	
STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> √ increased competitiveness; √ better accordance with legislative decisions. 	<ul style="list-style-type: none"> √ increased management costs; √ increased cost of some products (new technologies that are less wasteful).

Our next task is to evaluate the readiness of enterprises of the mining industry to adapt their business model

according to the new standards for environmental and social impact and good corporate management.

The results have found expression in Table 2 by Crosstab. Using it we visualize the readiness assessments in the enterprises of the mining industry to adapt their business model in relation to the indicators for the balance sheet value of the assets, net sales revenue and average number of personnel for the reporting period. Considering the mining industry, there are no micro-sized enterprises in the sample. The greatest degree of readiness is observed in large enterprises, followed by medium-sized enterprises. Small enterprises have the highest percentage of *analyze further*, which is explained by limited financial and human resources and limited new technologies available to them. And is it possible for the business model to be adapted in high interest rates and inflation? Is it possible that high interest rates to act as a brake on the implementation of large-scale company projects in the spirit of the policy for a green future for Europe? *High interest rates vs green transformation?*

C. The role of the interest rates and monetary policy as key economic indicators in the context of environmental management and renewable energy resources, their rational and complex exploitation

In the dynamic times in which enterprises of the mining industry operate, the overarching purpose is to keep prices stable and inflation at a reasonable level in the medium term. It is in unison with the general economic policies of the European Union. In the Eurozone, the main and most important of the three tasks of the European Central Bank (ECB) is maintaining price stability, maintaining high employment and balanced economic growth [16]. The leading behavior by the ECB – reaching inflation in the context of and measured by the harmonized index of consumer prices – close to but under 2%. Our analysis shows that the ECB uses interest rate benchmarks to maintain stable prices in the euro area. The change in

TABLE 2 FINANCIAL, HUMAN AND TECHNOLOGICAL ASSESSMENTS

		Categories of businesses (Accountancy Act, amm. SG/ 26 dated 22 March)			
		Small enterprises	Medium enterprises	Large enterprises	
Are you ready to adapt your business model...	definitely yes	Count	3	9	19
		% within categories	25,00%	56,25%	79,17%
	more than likely	Count	3	5	4
		% within categories	25,00%	31,25%	16,67%
	we will analyze further	Count	6	2	1
		% within categories	50,00%	12,50%	4,16%
Total	Count	12	16	24	
	% within categories	100,0%	100,0%	100,0%	

(Source: authors' own research)

interest rates reflect on the interest rates of commercial banks granting loans. This respectively reflects on business investments in the mining industry [17]. At the moment, however, the enterprises of the mining industry are witnessing how central banks are rapidly raising interest rates – more than sixty such hikes have been announced in recent months [18]. They can be analyzed as a projection of the drastic change of monetary policy adopted after the global financial crisis in 2008, further reinforced by the COVID-19 crisis, the war between Russia and Ukraine and the limited resources of the planet. How could the enterprises of the mining industry make sense of the monetary policy when inflation is at record levels, economic damage at national, European and international are constantly increasing, and 2022 would rightly go down in history as the year of the great expensive.

A jarring cycle of monetary policy tightening is ahead. Distinguish between previous cycles, inflation is too high and the US Federal Reserve (Fed) will no longer guide markets [19].

In contrast to the current moment, when inflation is too high, in previous periods the “tightening” of monetary policy was implemented preventively, i.e. purposefully in an effort to prevent inflation from accelerating rather than slowing it down [20].

In this regard, the results of our research have found expression in Table 3 by Crosstab, resp. we compare estimates of the impact of inflation and high interest rates on the green transition by the categories of businesses. There are no micro-sized enterprises in the sample. 90,38 % of the sample answered *yes, definitely*. Large enterprises have the largest share, followed by medium-sized enterprises and small enterprises. Nearly 6 % of all respondents answered *more than likely* and almost 4 % of them answered *we will analyze further*. In the Context of

TABLE 3 INFLATION/ HIGH INTEREST RATES-GREEN TRANSITION

		Categories of businesses (Accountancy Act, amm. SG/ 26 dated 22 March)			
		Small enterprises	Medium enterprises	Large enterprises	
Does inflation and high interest rates affect the green transf...	definitely yes	Count	11	15	21
		% within categories	91,67%	93,75%	87,50%
	more than likely	Count	1	-	2
		% within categories	8,33%	0,00%	8,33%
	we will analyze further	Count	-	1	1
		% within categories	0,00%	6,25%	4,17%
Total	Count	12	16	24	
	% within categories	100,0%	100,0%	100,0%	

(Source: authors' own research)

D. Analysis of the connection between the economic and non-economic priorities of the enterprises of the mining industry, especially nowadays in the process of solving the global problem of transformation towards sustainable development

A monetary policy with high interest rates that suppresses inflation, inhibits economic growth and investment, and especially negatively affects by hindering the implementation of the Sustainable Development Goals (SDGs). The complete replacement of fossil fuels with carbon-free alternative energy sources is the ultimate goal of climate change policies [21].

IV. CONCLUSIONS

The future of the mining industry in Europe is associated with modern technologies, digitalization of working processes, innovative software solutions and ways to protect the Environment. It is green and sustainable.

First. The empirical research, that was carried out in the enterprises of the mining industry from the target group, confirms that the environmental management system is a key factor for the eco-efficiency, management of natural resource and sustainable development.

Second. The observations in the practice of the mining industry and the analyzes carried out in the context of environmental management and its protection prove that a working ecological business system provides a complete integration of economic and environmental purposes.

Third. We need the wisdom of the past in making decisions and one and only integrated application of a complex approach with care about our unique Earth and its riches for the future.

The results of our research visualize the perspectives for the development of environmental management system with an emphasis on the enterprises of the mining industry in the short and long term.

The dominant idea is that the sustainability implementation of the environmental management system in the enterprises of the mining industry shall contribute to the successful realization of green transformation of the business sector, management of natural resources and protection of a cleaner environment, tracking the importance of digitalization and innovation of working processes, activities and green thinking.

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