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Guidelines for the Development of a Green Business Model in Companies from the Raw Materials Industry

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Abstract: The dynamics of modern economic, social, and technological conditions place the framework of a new industrial model in the paradigm of Industry 5.0. This paradigm is related to advanced digitization, big data, and artificial intelligence, while highlighting the role that technology plays in addressing the new demands of the environment. As a result, it is the acquisition and development of competencies that become the basis for adapting the individual to changes that are wide-ranging, profound, and permanent. Changes at different levels, which are also linked, also mean that skills need to be constantly improved and developed to meet the needs and expectations of technology, the economy, and society. The management of enterprises in the raw materials industry should focus on what they offer as benefits and positive effects for the external environment and stakeholders and be able to show and communicate it to the public. This can be done through changes in management strategies and models, providing the necessary resources, and developing entrepreneurial and green competences at all hierarchical levels. The goal of this study is to create a green business model that works for the raw materials industry. This model should include both entrepreneurial and green skills so that the move to Industry 5.0 and the green economy is easier and faster. The analysis of this model yields guidelines for its practical implementation. The results show that one of the most important components of the developed green business model in the Industry 5.0 paradigm remains people and their competencies. Because of this, their education and training, as well as their growth as knowledgeable people and leaders, along with the steady development of their unique skills and abilities, are the most important factors that determine how well they can handle different kinds of changes and crises.

Keywords: Business engineering, Green business model, Industry 5.0, Green competence

Introduction

The business model for the management of industrial enterprises is a new strategic model that integrates sustainability, initiative, entrepreneurship, and environmental responsibility in business processes. Its goal is not only to reduce the harmful impact on the environment but also to implement cost-effective and long-term solutions and practices that have a beneficial impact on all stakeholders. In terms of content, the green entrepreneurial model integrates various components: environmental, technological, economic, and socio-governance components. From the point of view of industrial business, the development and implementation of a green model shows the potential to achieve higher efficiency in the use of resources and cost reductions, leading to greater competitiveness. From an environmental point of view, such a model aims to reduce carbon emissions, more efficiently manage natural resources—scarce, exhaustible, and non-renewable—and protect biodiversity and the environment. Over the past few decades, extractive industries have undertaken numerous initiatives to prevent, mitigate, and minimize the adverse effects associated with extractive waste management and extraction activities (Tomova, 2023).

Consequently, this form of the model is mutually beneficial and widely useful, supporting sustainable development in the long term and supporting the transition through the green transformation and entry into Industry 5.0. The inclusion of different aspects and stakeholders makes it open and allows for greater decentralization, which increases its usefulness and applicability.

Historically, the imposition of the green business model has been associated with a growing awareness of the need for sustainable business development and the adoption of specific strategies and policies that will lead to concrete changes. The natural pursuit of business development and profit has been upgraded by adding a new component—sustainability in its various dimensions, including environmental, social, and economic sustainability. Global environmental challenges, including climate change, air and water pollution, drought, and depletion of natural resources, force industrial businesses to adapt to new realities and production to reorient themselves on a fundamentally new basis. Many of the traditional production approaches based on the objective of maximizing profits at the expense of the environment are no longer acceptable and relevant to modern requirements and strategic objectives at the national and European levels. Consequently, it became evident that we should not pursue economic development at the cost of adverse effects on the environmental and social landscape. The development of industry and society is oriented towards a new paradigm—economic activity is planned and developed not against nature, the living environment, and the health of people, but for and in relation to them. The transformation necessary to achieve this goal leads to the development of new business strategies and policies in which sustainable practices and standards are a key element and are reported and communicated to the public.

More and more industrial enterprises in various industries are developing and implementing their own green business models today as they continue to establish and improve them. In this way, they adapt, manage change, and take responsibility for the impact of their activities and their results on the environmental, social, and economic environment. Through the green model, they aim for a greater and wider positive impact, opening up the processes and including new components and stakeholders in them. In the new context, more and more complex and interdisciplinary solutions are being sought and implemented to reduce carbon emissions and waste and to orient processes and results towards people and society in search of greater usefulness and added value. Technologies related to renewable energy, biodegradable products, sustainable agriculture, and circular and green economy offer new untapped opportunities for business and entrepreneurial initiatives. Such initiatives also imply the use of green business models at their launch. Given its pronounced advantages, the green model is establishing itself as a leading trend for the industrial business, in particular in the raw materials industry. This is because the industry consciously strives for competitiveness at the global level and finds adequate responses to the changing requirements of consumers and regulators.

The existence of new business and economic realities poses challenges but also opens up new opportunities for potential and current entrepreneurs who are ready to adapt their strategies to changes and benefit from them. Given that the transition to a green economy is a fact, seizing new opportunities for entrepreneurial initiatives and developing responsible and sustainable innovations also require the "greening" of models. As a result, businesses that adapt in a timely manner have the potential to be more competitive and overcome challenges faster.

Background Theory and Literature Review

In this section, a systematic literature review was conducted to comprehensively evaluate and interpret all available research relevant to a specific research question and topic area. Contemporary business trends underscore that sustainability and resilience have become pivotal pillars for organizational survival and long-term growth. In the contemporary global economy, entrepreneurship serves not only as a catalyst for productivity, employment, and innovation (Korkmaz & Oral, 2023) but also as a driving force for societal advancement by addressing pressing environmental and social challenges. A green business model presents a versatile framework applicable across enterprises of varying scales and sectors, offering a pragmatic pathway for seamlessly integrating sustainability into business operations (Aini, 2025).

One of the critical strategies identified in the literature for achieving sustainable corporate entrepreneurship is the adoption of a green entrepreneurship orientation. This orientation adapts the traditional entrepreneurial orientation—marked by innovativeness, proactiveness, and risk-taking (Covin & Lumpkin, 2011; Makhloufi et al., 2022)—to pursue sustainable actions. In parallel, organizational resilience capacity is recognized as essential; it represents the ability of organizations to plan, monitor changes, and respond effectively during crises (Hillmann et al., 2022). The synergistic combination of green entrepreneurship orientation and

organizational resilience capacity is seen as a strategic enabler that not only helps companies respond to stakeholder pressures but also drives green innovation (Do et al., 2022).

Research has increasingly pointed out that the successful implementation of sustainable and resilient strategies requires a blend of technological knowledge and environmental problem-solving skills (Makhloufi et al., 2022). Moreover, the literature highlights a significant gap in understanding how established firms, particularly in industries with high environmental impacts such as the raw materials sector, can integrate these capabilities to foster green innovation (Mondal et al., 2023). The importance of green entrepreneurship is further reinforced by its positive economic implications. By producing environmentally friendly goods and services, firms not only sell and make a profit, they also contribute to the common good. This inherent adaptability enables organizations to sustain their competitiveness amid rapidly evolving market dynamics (Silajdzic et al., 2014; Zhang et al., 2024).

Moreover, bibliometric evaluations indicate a significant increase in academic research concerning green innovation, sustainable business practices, and ecological entrepreneurship, especially following the year 2020 (Albort-Morant et al., 2017; Arora et al., 2023). The main topics of these studies are the growth of intellectual capital, multidisciplinary approaches to green economics, and the theoretical foundations of long-term business models (Jiang et al., 2024; York & Venkataraman, 2010). These findings highlight a significant paradigm change, in which conventional financial goals are being replaced by comprehensive plans that incorporate social and environmental factors (Teran-Yepez et al., 2019) to augment their market demand and profitability while also fostering innovation in business structures.

Furthermore, green entrepreneurship is seen as instrumental in addressing global challenges like resource depletion and climate change, and the green model is the means to achieve this goal. The adherence to sustainable practices— encompassing the utilization of renewable resources and the minimization of waste— constitutes a fundamental pillar in fostering a balanced and symbiotic relationship with the natural environment (Tuncer & Korchagina, 2024; Kuzmenko et al., 2024). Therefore, green entrepreneurship transcends the mere promotion of industrial and technological progress (Dima, 2021); it also corresponds with the overarching aims of the United Nations Sustainable Development Goals by redefining traditional concepts of commercial success and endorsing enduring sustainable development (Sreenivasan & Suresh, 2023).

Taken together, the studies on the green models suggest that the Fifth Industrial Revolution did not automate physical labor so much as the way of thinking and conceptualizing. Enterprises are rapidly developing and implementing systems based on artificial intelligence, automation, and algorithms. The amount of data that accumulates is large, exceeding the capabilities of a person to process and understand it and make management decisions based on it. The need for data analysis and accelerated scientific and technological progress led to the permanent imposition of a trend for the inclusion of machines and artificial intelligence in many activities and operations. As a result, people begin to change their place in the labor process and orient themselves toward acquiring a set of new competencies in order to remain active and adequate to the needs of the labor market and the positions they occupy. It becomes clear that only investments in the knowledge economy lead to a sustainable increase in incomes. The accelerated penetration of technology leads to the need to increase people's competences, which thus creates real growth for the economy.

Therefore, investments in enterprises should be directed not only to the automation and digitalization of processes but also, in parallel, to the development of skills, knowledge, and new attitudes toward the evolution of paradigms. Industrial development has so far been based on the principle that labor is the main source of added value. In the framework of Industry 5.0, however, the added value shifts to competences, talent, and skills, which become a necessary condition for the imposition of the new industrial paradigm. What requires careful study is the creation of a specific green model in the mineral industry, since the issue has not yet been thoroughly considered in the scientific literature and is relatively poorly represented in practice. This is due to the novelty of the paradigm, the varying stages of industry development in different countries, the introduction of Industry 5.0, and the "greening" of the economy.

This study is based on the premise that the implementation of new technologies has a significant impact on people during their work activities and leads to significant changes. By incorporating digitization and Industry 4.0, concepts in mineral mining and processing industries are becoming increasingly essential (Culchesk, A. et al., 2017, Dimov et al., 2020).

In addition, digital technology can enhance the efficiency, safety, and sustainability of mining and processing (Beloglazov et al., 2020). By leveraging data analytics, real-time monitoring, and automation, mining

processing plants can achieve higher productivity and reduce environmental impact (Beloglazov et al., 2020). However, in the light of the rapid change of technology, smart manufacturing is undergoing transformation driven by two distinct paradigms: Industry 4.0 advocates for the shift towards digitization and automation, while the emerging Industry 5.0 prioritizes human-centric approaches (Argilovski et al., 2024). People are the first to discover and encounter specific problems in practice and then look for a solution to overcome them with the help of new technologies.

Industry 5.0 is predominantly characterized by customization, human-centricity, high-tech products, and high social and environmental impact, leading to more expressed support for the need for sustainability (Argilovski et al., 2024). According to the new production model, based on the concept of Industry 5.0 and the green economy, the future of industry is not only related to the development of machines and technologies but also to the evolution of man, human potential and capacity, and the logical change of his role in the processes. In the new conceptual framework for the development of industry, man is not displaced by the machine and artificial intelligence (AI) but is repositioned and retrained, and his role is changed. The reasons for this are objective—automation, digitalization, and digitization will change job positions, their duties, and their responsibilities. As a result, the requirements for the qualification of workers in industrial enterprises will also change so as to achieve symbiosis between man and machine in the work process.

In this changed context, entrepreneurial competence becomes critically important not only for developing one's own business initiatives but also for finding employment, retaining one's job, and career development. The ability to recognize, create, and use opportunities, as well as manage processes that create added value and utility, is the primary expression of entrepreneurial competence. As a multifaceted and wide-ranging competence, it implies and requires in-depth analysis and knowledge of the context, environment, opportunities, and one's own potential, which can be further developed over time. In turn, entrepreneurial competence and initiative become a necessary condition for acquiring green competence, because they imply a desire for adaptability, activity, development, and accumulation of new knowledge in the field of green and circular economy.

Sustainable living and business organizations require a change in thinking and behavior, with an emphasis on equality and justice for current and future generations in terms of consumption opportunities. Our relationship with the environment must be based on an awareness of our connection with nature. People who are keen to learn green skills need to be able to think about things in a more complete way and question the way economic systems work now. They need to be able to change these systems to fit new social, environmental, and governance (ESG) factors, which means they need to change their plans and strategies. To be effective, this knowledge acquisition must be accompanied by the accumulation of experience in green practices and initiatives. It is important to encourage both individual and collective efforts to transform society and create a sustainable future in the context of Industry 5.0 and the green economy. The implementation of the green business model is a way to ensure adequacy to the requirements and relevance to the development prospects of the industry, in particular the raw materials industry. The model helps enterprises adapt to global trends and achieve greater sustainability in their activities. This not only creates prerequisites for innovation but also creates value for society by supporting social responsibility and sustainable development.

In summary, the integration of green entrepreneurial orientation and organizational resilience capacity within a green business model offers a promising avenue for sustainable corporate entrepreneurship and business. This approach enables firms—especially those in environmentally sensitive sectors—to achieve competitive advantages while addressing critical global issues. Future research should further explore the interplay between technological capabilities, environmental problem-solving skills, and strategic initiatives in green entrepreneurship. This will provide deeper insights into the evolving dynamics of green innovation and help establish a more robust theoretical foundation for sustainable business practices, ultimately driving both economic growth and environmental stewardship.

The literature analysis developed in this section shows a notable lack of examples of how to use the green model in industrial practice. We can identify a gap between the real need to implement relevant transformations and the existing theoretical framework that serves as the foundation for these transformations. As a result of an analysis of theory and good practices, it is useful to derive specific guidelines to facilitate the implementation of such models. Based on these statements, the scientific apparatus of the study was formulated, and a specific research question was derived.

We then formulate the following research question: how can we construct an exemplary green business model that is applicable to the raw materials industry? Our aim is to address these challenges and provide guidelines

that would facilitate and accelerate its implementation. The contributions of our study are sought in offering a model that is practically oriented and actually applicable and synthesizing specific recommendations through which the model will have greater applicability and value.

Methodology

In order to reach the main goal of the research, we based it on the background theory and literature review and on surveying the opinions of employers through surveys. The purpose of this study is to derive a green business model and guidelines for its implementation. The model should work in the raw materials industry and include both entrepreneurial and green skills because of the new tendencies in economy and industry. This will make the move to Industry 5.0 and a green economy easier and faster.

The methodology for developing the model and guidelines for it includes research of scientific literature, analysis, synthesis, conducting a survey among business representatives, summary, systematic, heuristic, and graphical approaches. Through looking at how entrepreneurs work and think in the raw materials industry and figuring out what skills they need, the chances of putting Industry 5.0 into practice in both new businesses and old ones are also evaluated. We examine the opportunities and challenges that the introduction of Industry 5.0 technologies presents for entrepreneurial development in the raw materials industry.

The hypothesis is tested that the creation of a green business model supports the development of business and activities related to innovation and the greening of the economy, which in turn create new business ideas and opportunities for innovation and the development of new entrepreneurial initiatives. At the heart of the hypothesis testing is the verification and understanding of the importance of entrepreneurial and green competence, because the model should also reflect the competence framework. However, this analysis requires a review and rethinking of the models and the introduction of new elements and concepts to them. In order to verify the hypothesis, the search for opinions based on a survey and the determination of employers' attitudes are the main tasks of the study, through which to fulfill the goal. On this methodological basis, a green model is derived and proposed, and generalizations are formulated—guidelines for the applicability and increasing its usefulness and effectiveness in the raw materials industry. The study's limitations are defined by the lack of active participation from business representatives in survey studies and the challenges associated with gaining access to them. The results become the basis for drawing conclusions—guidelines for practice. The sought contribution from the study is of a theoretical and applied nature.

Analysis and Results

A Questionnaire Survey

We conducted a survey of employers in Bulgaria's raw materials industry over several months in 2024. The aim of the survey was to determine the necessary competencies of human resources currently employed or with future employment in their companies. By carrying out this task, an attempt is made to derive a certain competency profile of personnel in the raw materials industry. The survey involved 11 large and medium-sized companies in the raw materials industry with a total number of over 5,000 employees. Their distribution according to company size is as follows: 71% of the surveyed enterprises have over 250 employees, and the remaining 29% have over 50 employees. The distribution according to company size is presented graphically in Figure 1.

The questions that were asked of the business representatives concern the knowledge, skills, experience, and attitudes possessed by the employees, which are implicitly included in the content of entrepreneurial and green competence. The questions were made to find out if the business agrees with the idea that entrepreneurial and green skills are crucial for building the skills of human resources in the raw materials industry in the context of Industry 5.0 and the green economy.

The field in which the respondent works is, as expected, predominantly in the field of human resources, training, and development of personnel—57.1% of respondents. The rest of the respondents are engaged in production activities, exploration, and extraction (14.3%); are responsible for ESG (14.3%); or hold a managerial position (14.3%) (Figure 2).

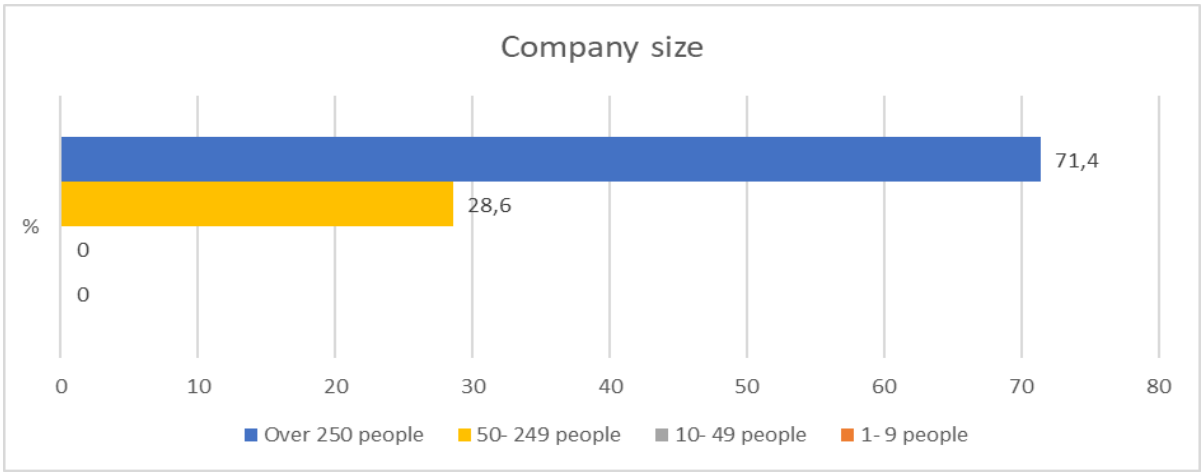

Figure. 1. Company size (Source: Own survey among business representatives, 2024)

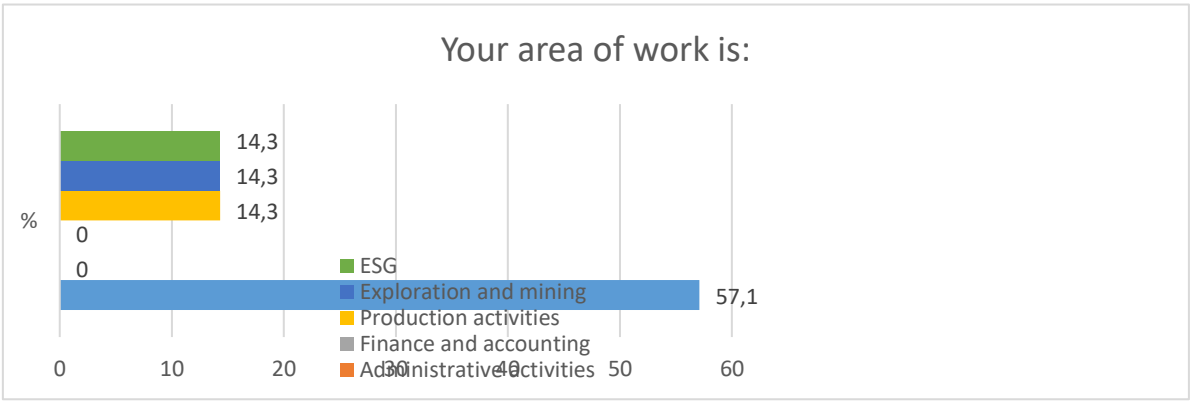

Figure 2. Field of work of the respondents Source: Own survey among business representatives, 2024

Employers' opinions on the importance of skills related to entrepreneurial and green competence for the career development of employees in their companies are presented in Figure 3 and Figure 4.

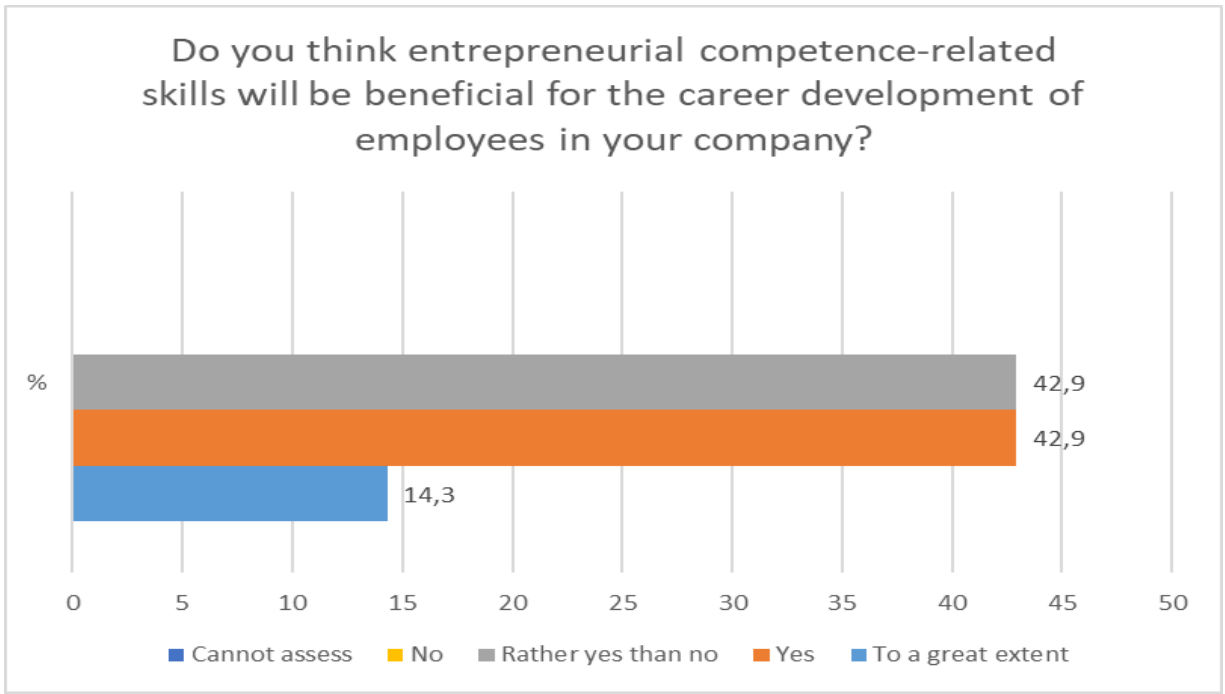

Figure 3. Employers' opinions on the importance of entrepreneurial skills for career development (Source: Own survey among business representatives, 2024)

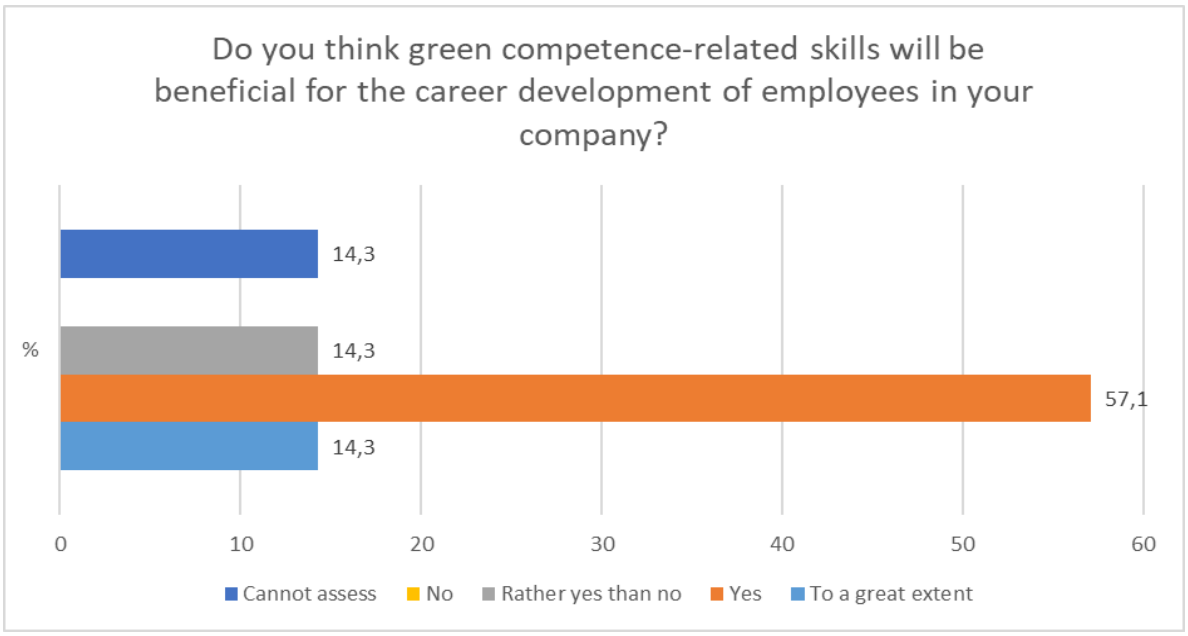

Figure 4. Employers' opinions on the importance of green competence skills for career development (Source: Own survey among business representatives, 2024)

The respondents believe that skills related to entrepreneurial competence are useful for the career development of their staff. The distribution of responses is as follows: "To a large extent" represents 14.3%, "Yes" represents 42.9%, and "Rather yes than no" represents 42.9%. Managers also believe that skills related to green competence (Figure 4) can help in the career development of workers and employees in their companies: "To a large extent"—14.3%; "Yes"—57.1%; "Rather yes than no"—14.3%; and "I cannot assess"—14.3%. It is evident that in enterprises from the raw materials industry, these skills are assessed as necessary, and accordingly, requirements are set for their possession and acquisition. This can be explained by the clear need to change models, strategies, and practices, and hence the change in the competence profile in the context of Industry 5.0 and the green economy. Employers' willingness to organize formal and/or informal training to develop entrepreneurial and green competence is the focus of the next question. This is a logical question, since the previous questions prove that they recognize it as important for the activity and career development of the personnel (Figure 5 and Figure 6).

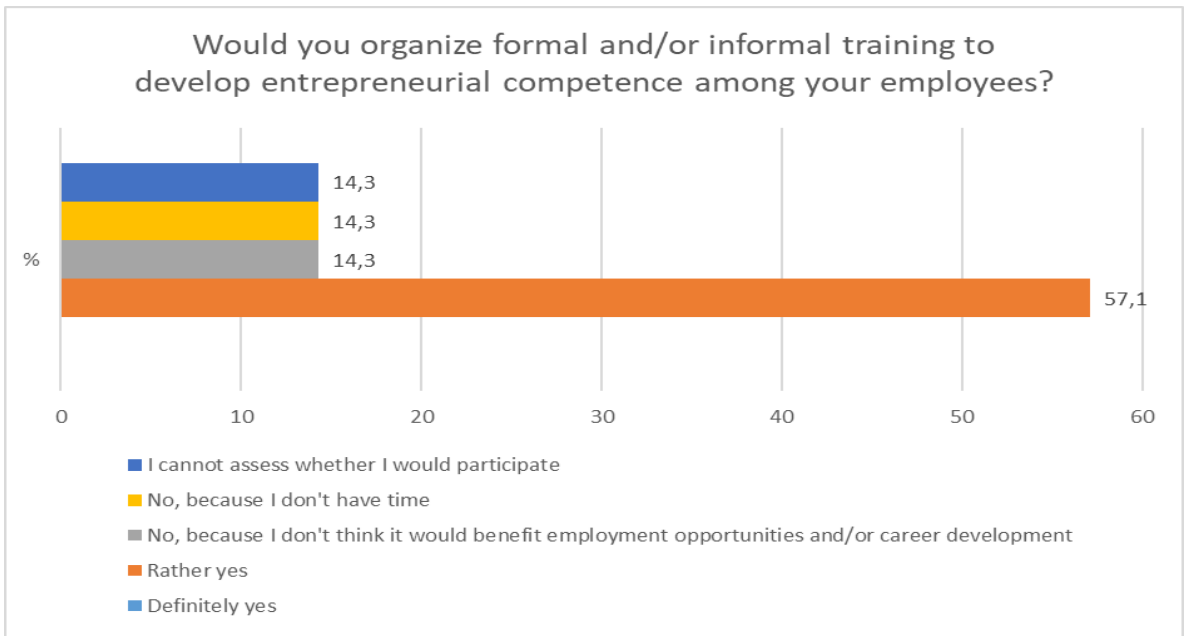

Figure 5. Employers' willingness to organize formal and/or informal training for the development of entrepreneurial competence (Source: Own survey among business representatives, 2024)

Figure 6. Employers' willingness to organize formal and/or informal training for the development of green competence (Source: Own survey among business representatives, 2024)

Representatives of companies in the raw materials industry largely believe that it is useful to organize formal and/or informal training for the development of entrepreneurial competence. The distribution of answers is as follows: "Rather yes" – 57.1%, "No, because I do not think it will be beneficial for the company" – 14.3%, "No, because I will need a lot of resources—financial and educational" – 14.3%, and "I cannot assess" – 14.3%.

The distribution of responses to the question of green competence is similar. The answers are as follows: "Categorically yes"—14.3%; "Rather yes"—42.9%; "No, because I don't think it will be beneficial for the company"—28.6%; and "I can't judge"—14.3%. The prevailing opinion is that employers should organize such training, because the future importance of the skills related to these two types of competences is recognized. It is striking that there is also a significant share of those who answered no, with the negative answer being justified by the lack of resources (financial and educational) and a share of those who answered that they could not judge. The lack of resources is often a factor in not undertaking or postponing training initiatives, seminars, and workshops that develop skills and lead to the accumulation of experience.

The lack of judgment is also explained by the great dynamics, rapid changes, and many new concepts that the business is not always familiar with in detail. As a result, prioritization becomes difficult, and assessing what is important, what is a priority for the company, and what changes need to be made requires in-depth management training and significant analytical capacity. Based on the study of attitudes about the importance and role of entrepreneurial and green competence among employers, it can be concluded that the need to upgrade competencies through training is recognized and justified. Employers categorically state that the acquired skills related to entrepreneurial and green competence are important for finding employment and for developing the careers of their workers and employees.

Over the past decade, it has become clear that companies that deliver value to society—to their customers, employees, and stakeholders—ultimately turn out to be the most profitable and competitive. The existence and development of enterprises in modern society is characterized by a new value orientation, the widespread use of digital technologies, the improvement of management methods, an orientation towards high-quality performance of tasks, and the achievement of long-term goals. All this is impossible without building a cohesive team of inspired and committed individuals dedicated to the goals of the organization (Trifonova, B., 2022, p. 186). Therefore, it is necessary to look for management models that create value and are more open, which would meet the need for stakeholder involvement.

The value proposition HR model was created by Ulrich and Brockbank (2005) under the name Human Resource Management that Creates Value. Ulrich and Brockbank believe that "human resource management that adds value creates a sense of benefit and value in the minds of specific groups of people—users, employees,

managers, and shareholders of the company's business—thereby helping them to achieve their specific goals (Ulrich & Brockbank, 2005, p. 26)". Their model includes five interrelated elements, depicted in Figure 7. The main idea of the model is that human resource management activities generate value in the broad sense of the word, including benefits for staff, managers, customers, investors, owners, and stakeholders.

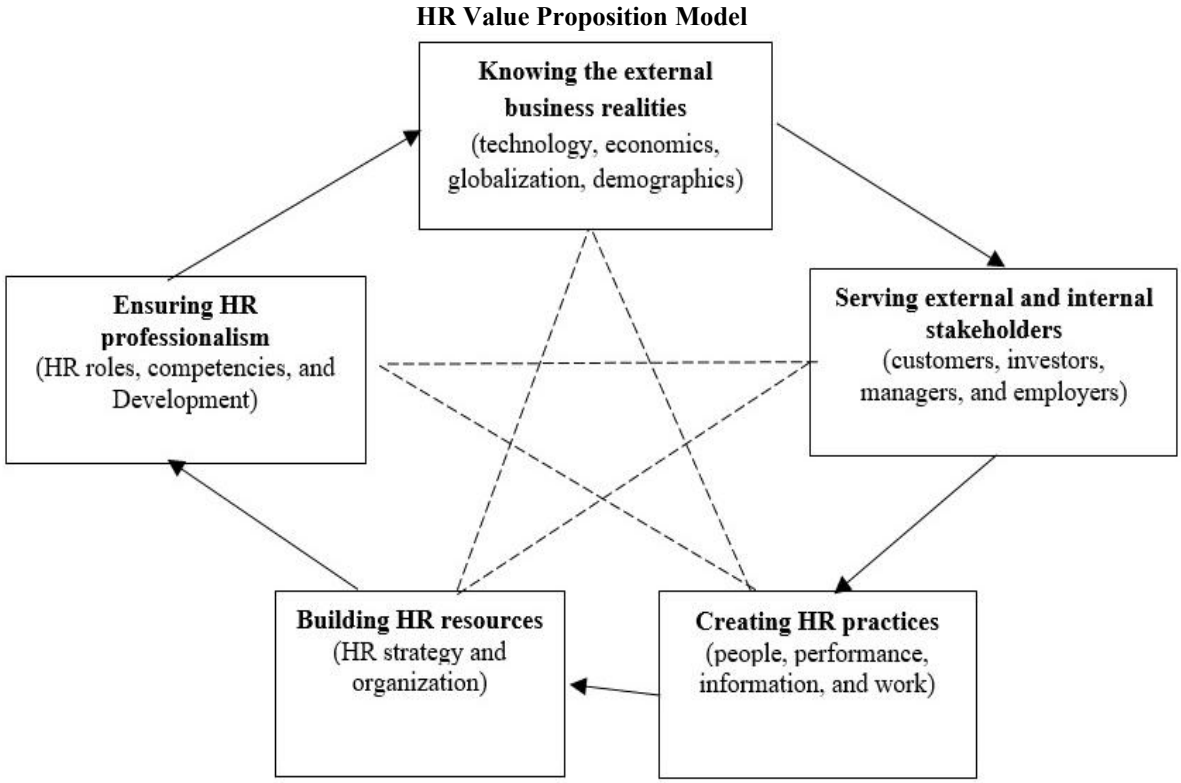

Figure 7. The Ulrich and Brockbank HR value proposition

Ulrich and Brockbank say that to make the changes that are needed from using this model, the five elements shown in Figure 7 must be consistently put into action. These elements should start with studying the outside business environment and move along the solid, continuous lines. Another approach is also possible—to follow the dotted lines or to start with an assessment of the competence of the staff, investment in resources, or another element. However, a mandatory condition for applying the model is the integrated implementation of all five elements, regardless of the choice of where to start.

The elements contain (Trifonova, 2019, p. 170):

- Excellent knowledge of the external business environment, which includes knowledge of new technologies, the economic environment, legal regulations, the demographic crisis, and imposed globalization;
- Excellent knowledge of the needs of stakeholders—staff, managers, clients, investors, and owners;
- Implementation of effective management practices in human resources management in the following areas: related to the movement of people and talent retention, related to the performance of tasks, performance assessment and remuneration received, related to the analysis of positions, and related to building the communication strategy in the organization;
- Providing the necessary resources to achieve the desired results—the organization is given the opportunity to link management practices in human resources management with the implementation of the business strategy;
- Ensuring high professionalism in enterprise management requires constant improvement in the competence of all managers within the organization.
- Ensuring high professionalism in work, which requires constant improvement of the competencies of employees in the organization, especially entrepreneurial and green competencies.

Businesses in the raw materials industry use good human resource management models because they want to create safe jobs with fair pay and long-term growth in areas where the extractive industry is strong (Trifonova, 2019, p. 171). Monitoring good practices and taking into account the attitudes of representatives becomes the

foundation for preparing and offering a green business model that is effective and applicable in an industrial environment.

Green Business Model

After looking at the study's results and the human resources management model, it is possible to come up with a model and make specific suggestions for the creation and use of similar models that include green competence in order for Industry 5.0 to enter the raw materials industry. In order to develop and justify such a model, Table 1 traces the stage sequence of mining operations and highlights the main actions of companies toward building their own green entrepreneurial model.

Table 1. Green entrepreneurial model of a raw material industry enterprise—sequence and stages

Stage of mining activities	**Stage scope**	**Actions to build the model**
Geological exploration	From the discovery of a deposit with a certain type of mineralization to a certain stage of exploration of the deposit: reconnaissance, prospecting, preliminary exploration, or detailed exploration.	Training the workforce in acquiring entrepreneurial and green competencies and opening up creative professions related to new technologies; Discovering new jobs in the virtual environment. Through the use of virtual manufacturing, the manufacturing process can be defined and verified at the beginning of the design process;
Mine site design	Feasibility study and preparation of the technical or working design for the deposit's development.	Informing local communities;
Construction	Construction of capital works, production and auxiliary buildings, purchase and delivery of machinery and equipment, and construction of infrastructure on the site.	Technological innovation, which leads to optimization of production processes, reduction of waste products, and improvement of resource utilization;
Mine commissioning and ramp-up	It covers the period from the start of production until the mine reaches full or near full production capacity.	Limiting workplaces where monotonous and health-hazardous activities are practiced;
Steady-state mine operation	This is the period during which the mine operates at full capacity and extracts reserves from the deposit.	Achieving sustainability, which includes workers having the skills to manage resources effectively, emphasizing recycling, renewable energy sources, and the sustainable use of natural resources;
Production decline phase	Decline in activity due to depletion of inventories and partial liquidation of no longer needed fixed and short-lived tangible assets.	Building effective partnerships with the community; Limiting the potential for job losses through training to acquire new digital and entrepreneurial skills and start their own business;
Mine closure or conservation	It mainly covers the period of liquidation or conservation of production facilities and completion of environmental restoration activities from the consequences of mining activities.	Prioritizing the well-being and prosperity of the community by financing new businesses in the region and working on projects and programs funded by the EU; Informing local communities about the sequence of actions to restore the environment, achieving visibility and transparency.

Based on these formulated and described stages and their sequence, a green business model applicable to enterprises in the raw materials industry is developed and proposed. The model is presented graphically in Figure 8.

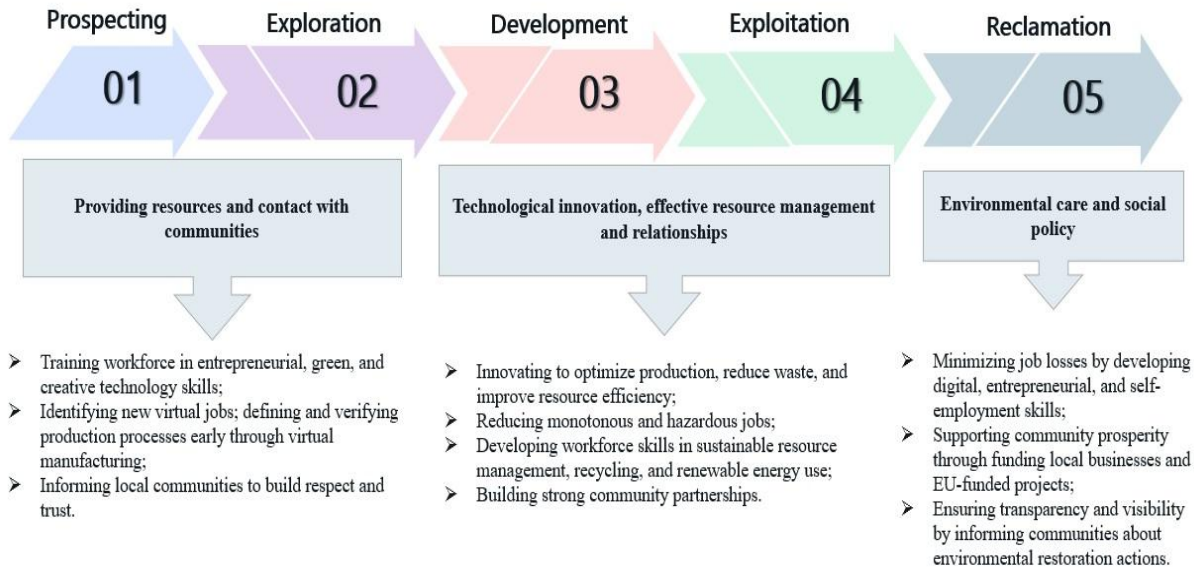

Figure 8. A green entrepreneurial model in raw materials industry enterprises

The relevant actions for building the model are as follows:

1. Providing resources and reaching out to communities
- Training the workforce in acquiring entrepreneurial and green competencies and engaging in creative and innovative professions related to new technologies.
- Discovering new jobs in the virtual environment. By using virtual manufacturing, the production process should be defined and verified at the beginning of the planning process.
- Informing local communities. Building respect and trust. Ensuring a transparent environment.

2. Technological innovation, efficient resource management, and relationships
- Technological innovation, which leads to the optimization of production processes, the reduction of waste products, and the improvement of resource use (efficiency) (Terziyski, 2024);
- Limiting the number of workplaces where monotonous and hazardous activities are practiced;
- Achieving sustainability, which includes the acquisition of knowledge and the development of skills for the efficient management of resources, with a main focus on recycling, renewable energy sources, and the sustainable use of natural resources (Hristova, et al., 2024);
- Using knowledge and skills in various initiatives to gain experience;
- Building effective, mutually beneficial partnerships with the community.

3. Environmental care and social policy:
- Limiting the potential for job losses through training to acquire new digital, green, and entrepreneurial skills and start your own business;
- Prioritizing the well-being and prosperity of the community by financing new businesses in the region and working on projects and programs financed by the EU and international funds;
- Informing local communities about the sequence of actions to restore the environment, achieving visibility and transparency.

The relevant actions are also guidelines for the possible sequence of steps that are complementary and through which the various components of sustainability can be ensured. The model is based on the principle of openness, seeking mutual benefit and involving a wide range of stakeholders in various processes. The main recommendations for its implementation are the use of a broader and integrated approach, reflecting feedback, seeking cooperation and coordination of strategies and goals, and seeking utility and added value beyond the economic aspect. The raw materials industry finds the model useful and applicable, but with adaptation, it can also discover its application in other industries.

Conclusions

The results of the study show that one of the most important components of the developed green entrepreneurial model in the Industry 5.0 paradigm is people, because the Fifth Industrial Revolution does not automate physical labor as much as thinking and conceptualization. People are the first to discover and encounter specific

problems in their practical activities and then seek a solution to overcome them with the help of new technologies. Therefore, their training and education, their development as informed individuals and leaders, as well as the consistent development of their specific skills and talents, are decisive factors for their suitability for serious transformations and crises of any nature.

The management of enterprises in the raw materials industry should focus on offering benefits to staff and stakeholders, seeking broad utility, and adequately presenting the results to the community. This can be done through internal changes in management practices, providing the necessary resources, including resource sharing, open models, and developing management capacity within the organization. It is recommended to create a relevant green entrepreneurial model, which includes both the acquisition of entrepreneurial and green competencies and management focused on value creation, stakeholder engagement, and open and decentralized approaches to creating and implementing innovations.

Technological renewal, imposed by Industry 5.0, is also needed, leading to the optimization of production processes, the reduction of waste products, improved resource use, and circular models. However, achieving sustainability is possible when workers have real practical skills for effective resource management and for working in a new work environment in which recycling, renewable energy sources, and the sustainable use of natural resources are emphasized. We have taken the first step in recognizing and accepting the importance of these skills. Further steps should be taken to change the strategies, policies, and models in the raw material industry enterprises, which should be consistently implemented, including focusing on training and actively involving employees in green initiatives. Such a strategic transformation also requires the development of competence in a wide range of specialists and managers who will plan, implement, and manage the process so that they can properly form and implement policies and strategies. This is possible by placing emphasis on education and training, formal and informal initiatives, and the search for the usefulness and applicability of new knowledge and skills in practice to achieve added value. Future research should explore the implementation of such steps and their impact, considering the study's limited scope. Furthermore, the study sparked pertinent academic discussions about future research directions and pinpointed knowledge gaps that require attention.

Scientific Ethics Declaration

* The authors declare that the scientific ethical and legal responsibility of this article published in EPSTEM Journal belongs to the authors.

Conflict of Interest

* The authors declare that they have no conflicts of interest. The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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