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ESG RISK MANAGEMENT SUPPORTED BY ARTIFICIAL INTELLIGENCE SYSTEMS

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Purpose: ESG risk management and adapting to decarbonization requirements are among the key challenges European industrial enterprises will face in the upcoming decade. Addressing this challenge will involve the significant role of new technologies, particularly artificial intelligence. This article discusses research aimed at evaluating the effectiveness of a system utilizing artificial intelligence for risk management in the process of managing ESG goals.
Design/methodology/approach: In order to achieve the intended goal, the following research questions were formulated: Does the implemented system support the realization of ESG objectives in the studied organization, and would these objectives be achieved without implementing an AI-supported ESG risk management system? The research was conducted in a petrochemical sector company using qualitative methods (systematic literature review, case study description, self-observation and participant observation, informal interviews with selected system users). Due to the qualitative nature of the research, according to the methodology, no research hypotheses were formulated. Both the purpose of the research and the content of the above-mentioned issues indicate that they fit into the functional-systemic paradigm.
Findings: The analysis of research results indicates that the ESG risk management system based on artificial intelligence algorithms contributes significantly to the realization of ESG objectives in the studied organization. Additionally, managing the ESG risk in the organization is possible without implementing a system supporting this process, however, the effectiveness of such actions is limited significantly.
Research limitations/implications: Limitations result from the adopted research method. The systematic literature review, despite following the procedure derived from management and quality sciences, may be incomplete. Cited studies were conducted in various organizations and cultures. The case study description does not apply to every organization. Furthermore, self-observation as a method may be burdened with subjectivity, resulting from, among other things, the researcher's experiences.
Practical implications: Among technologies with the highest potential for managing risks in the ESG area, particularly in the context of decarbonization, artificial intelligence undoubtedly stands out. AI has the most significant impact on the digitalization of the economy, the implementation of the 2030 Agenda, the Green Deal, and the Paris Agreement. AI integrates most of the Industry 5.0 technologies and has the most crucial impact on supporting the

realization of climate goals – from monitoring trends, predicting weather events, to specific solutions reducing or completely eliminating greenhouse gas emissions.
Originality/value: The results of the conducted research demonstrate the significant potential of using artificial intelligence in managing ESG goals, especially in the implementation of decarbonization objectives and the digitalization of production processes in industrial enterprises. Additional value is the possibility of ensuring economic (cost reduction of processes), practical and reliable, high-quality production, as well as accelerating data analytics in the pursuit of identifying risks and achieving ESG goals.

Keywords: artificial intelligence, management, ESG, sustainable development.

1. Introduction

In publications discussing the role of artificial intelligence in the economy, it is emphasized that we are currently dealing with the fourth revolution, which results from the development and implementation of both artificial intelligence and other technologies (Pouliakas, 2021). In many industries, artificial intelligence reduces the number of repetitive tasks previously performed by employees (cf. Parker, Appel, 2021). Proponents of artificial intelligence have envisioned a scenario in which intelligent machines would perform routine tasks previously reserved for humans, freeing them to engage in creative activities. Nevertheless, there is widespread fear of potential job loss (Jaiswal, Arun, Varma, 2022). Awareness of the advantages and limitations of using artificial intelligence is also growing (Lou, Wu, 2021). There is no doubt that the dynamic development of artificial intelligence systems and automation is rapidly changing employment needs, professional skills, and the structure of work (Chuang, Graham, 2020).

One of the currently dominant areas of artificial intelligence application is management. It is increasingly being implemented, for example, in innovation management processes (Liu, 2022, p. 1). It is the result of an innovation process and influences or is influenced by contextual structures (Navneet et al., 2020; João Correia, Matos, 2021). In the previous decade, a relatively large number of research and implementations concerned the use of artificial intelligence in financial management. This trend continues (Yubo, 2021; Ghandour, 2021). The pandemic has prompted the financial sector and the business world to pay even more attention to the possibilities offered by artificial intelligence. (www; Soon, 2021).

Research continues to focus on improving decision support systems (Gupta et al., 2022; Patalay, Bandlamudi, 2021). Artificial intelligence is used in big data management processes, including the integration of knowledge generated throughout the product life cycle. The aim is to ensure economic, practical, and reliable production and improve product quality (Luo, Li, Yu, 2021).

Artificial intelligence, including affective data processing, is one of the most important and popular technologies currently used by educational institutions for data conversion and big data analysis (Aljarrah et al., 2021). One of the biggest beneficiaries of artificial intelligence is the business sector, especially in the era of Industry 4.0. The main idea of the fourth industrial revolution (4IR or Industry 4.0) is the digitization and integration of all elements and processes in a company (Blazek, 2021; Yu, Liang, Xue, 2022). New technologies characterized by high-performance computing potential enable the creation of complex artificial intelligence systems (Oliveira et al., 2021). Artificial intelligence also supports processes aimed at improving the state of the environment (Kshirsagar et al., 2022), e.g., in the design and operation of water supply systems (Czapczuk, Dawidowicz, Piekarski, 2015). AI solutions are also helpful in measuring, reducing, and mitigating the effects of emissions and greenhouse gases (GHG)[1].

Businesses have been eager to employ various programs and applications, realizing the potential benefits they may enjoy. Scientific publications often point to the possibility of reducing the costs of various processes or accelerating them, for example, in the field of data analytics (Lou, Wu, 2021).

AI also enables the aggregation of ESG-related information, which is currently provided in various reports, allowing comparisons and decision-making by companies, market participants, and rating agencies (https://www.ey.com…).

Existing research focuses mainly on ESG goals and risk management methods. However, the area of key interest in this study is the extent to which there are opportunities for the application of artificial intelligence. Therefore, after reviewing the literature, we have formulated research objectives, which involve evaluating the effectiveness of a system that uses artificial intelligence for risk management in the process of managing ESG goals.

2. Review of previous research

Currently, sustainable development management and disclosure of ESG indicators are gaining importance and becoming a significant element in the evaluation of companies in investment processes, seeking financing, or company valuations. Over the past decade, the efficiency of managing ESG factors has become strongly integrated with their investment value, particularly with the perception of risk levels. Measuring ESG performance indicators is already standard for large companies, especially public ones. A challenge for both companies and their stakeholders, such as investors, ESG analysts, financial institutions, and insurance companies, is the strategic management of ESG factors, particularly in data analysis, goal-setting, and risk prediction. ESG data management tools are necessary both for companies that

[1] Report developed in collaboration with Boston Consulting Group (BCG) and BCG GAMMA.

must integrate ESG goals with business objectives and from the perspective of investors or banks, which are obliged to assess the risk of invested funds or insured assets. Artificial intelligence may be the answer to the growing needs in the field of ESG data analytics. The increasing importance of ESG in financial institutions' risk management requires the creation and implementation of innovative evaluation techniques. There are many potential benefits associated with implementing artificial intelligence systems dedicated to ESG risk management. The literature on the subject indicates that these systems:

- can significantly help reduce CO2 emissions (McKane et al., 2017),
- directly support an organization's impact on the environment and improve ESG risk analysis and assessment processes, leading to improved financial results for companies and investors (Bassani, Osorio, 2017),
- contribute to reducing an organization's carbon footprint and improving the implementation of climate goals (Field, 2019),
- are used as a support tool to reduce greenhouse gas emissions (Ginevicius et al., 2021),
- support sustainable organizational activities (Brem et al., 2020).

In the available literature, one can notice that there are many motives for implementing ESG risk management systems. These include:

- drawing stakeholders' attention to the faster and more drastic climate changes, enabling the identification and mitigation of risks related to ESG issues, and improving the company's image while reducing costs associated with ESG risks (Sousa Jabbour et al., 2017),
- aiming to reduce costs associated with production or services (Karcher, Jochem, 2015).

Analysing the research results presented by various authors in the literature, it can be concluded that:

- there is a lack of publications that, on the one hand, would indicate methodological possibilities, and on the other hand, empirical examples of effective ways to assess the potential effects of implementing ESG risk management systems (McKane et al., 2017; Jovanović, Filipović, 2016).

Managing ESG risks and adapting to decarbonization requirements are key challenges for European companies in the coming years. Accenture's research shows that digitalization, particularly technologies such as AI, Cloud, 5G, IoT, and Big Data, will play a crucial role in addressing these challenges.

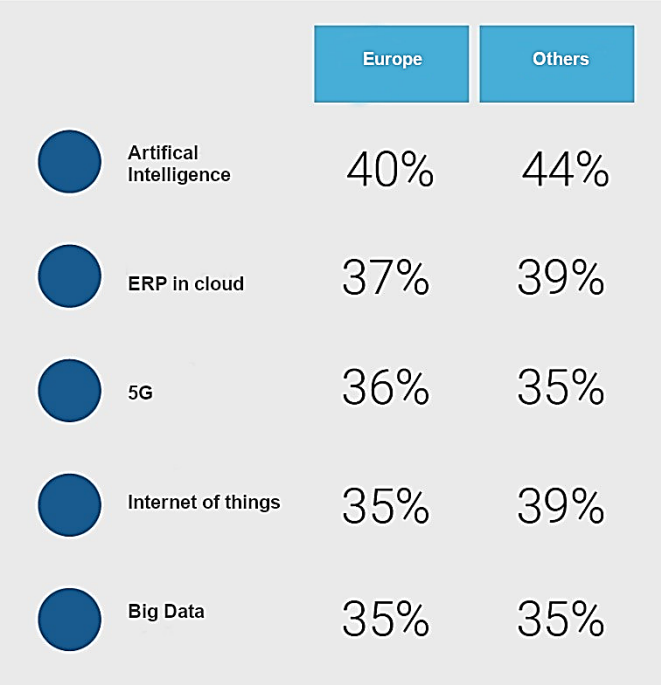

Figure 1. European companies plan significant investments in cutting-edge technologies.
Source: Accenture.

Among the technologies with the greatest potential for managing risks in the ESG area, particularly in the context of decarbonization, artificial intelligence stands out. AI has the most significant impact on the digitalization of the economy, the implementation of Agenda 2030, the Green Deal, and the Paris Agreement. AI integrates most of the Industry 5.0 technologies and has the most crucial impact on supporting climate goals – from monitoring trends to predicting weather events and implementing specific solutions that reduce or eliminate greenhouse gas emissions.

Considering the above content, the research goal is to evaluate the effectiveness of a system using artificial intelligence for ESG risk management in the examined company. To achieve the intended goal, the following research questions were formulated:

P1. Does the implemented system support the achievement of ESG goals in the studied organization?

P2. Would these goals be achieved without the implementation of an ESG risk management system using artificial intelligence?

3. Research Method

To address the aforementioned problems, qualitative methods were used. According to the problem classification, these methods have a practical nature (Lisiński, Szarucki, 2020, p. 106; Pszczołowski, 1978, p. 184). Due to the qualitative nature of the research, in accordance with

the methodology, research hypotheses were not formulated. Both the purpose of the conducted research and the content of the problems presented above indicate that they fall within the functional-systemic paradigm (Lisiński, Szarucki, 2020, p. 76). The following methods were used to conduct the research:

- systematic literature review (e.g., Creswell, 2013, p. 49 et seq.),
- case study description (e.g., Stake, 2014, p. 623; Dźwigoł, 2018, p. 72) and within its framework,
- self-observation and participant observation (e.g., Ciesielska, Wolanik Boström, Öhlander, 2012, p. 41 et seq.; Babbie, 2009, p. 325),
- unstructured interviews with selected system users (e.g., Kvale, 2012; Kostera, 2003, p. 121).

The case selection was purposeful, as the study's assumption was to focus on a specific ESG risk management system based on artificial intelligence tools rather than another system functioning within the integrated management system in the enterprise under investigation. The authors were interested in the effectiveness of this system after an initial period of operation (Ryan, Bernard, 2000). The same applies to the selection of respondents and the area of the organization in which the study was conducted (e.g., Flick, 2012, p. 62 et seq.). In the case study, a small group of people collaborates with the AI-based ESG risk management system. Interviews were conducted with respondents to document their opinions on the actual impact of the system on the ability to effectively manage ESG risks. The research was carried out in a petrochemical production company in January-February 2023.

4. Results of the conducted research

In the studied company, an ESG risk management system based on artificial intelligence tools operates in the scope of decarbonization modules. The utility billing analysis module uses regression models to normalize energy performance for weather indicators and KPIs, allowing for the measurement and tracking of savings relative to reference periods over time. The interval utility meter analysis module uses rule-based analysis and AI algorithms to automatically detect exceedances of expected demand or media consumption. The sustainable development program tracking module is equipped with a scenario modelling tool and savings tracker, which supports the investment decisions of sustainable development projects.

In relation to the first research question [P1], considering both the content analysis of available documents and self-observation and participant observation, it was found that the ESG risk management system implemented in the organization, based on artificial intelligence algorithms, significantly contributes to the achievement of the ESG goals of the studied organization.

Considering the second research question [P2], it should be noted that ESG risk management in the organization is possible without the implementation of a system supporting this process, but the effectiveness of these actions is significantly limited. Thus, the implementation of the system improves the efficiency of ESG risk management in the organization.

Limitations

The limitations stem from the adopted research method. The systematic literature review, despite following the procedures from management and quality sciences, may be incomplete. The cited studies were conducted in various organizations with diverse cultures. The case description does not apply to every organization. Meanwhile, self-observation as a method can be burdened with subjectivity, resulting from, among other things, the researcher's experiences.

5. Conclusions

Referring to the assessment of the effectiveness of the ESG risk management system supported by AI tools, which is the subject of the study, the following observations can be formulated based on the presented results.

In recent years, responsible investment in sustainable development has evolved, and today it is referred to as a "megatrend" in the world of finance. Businesses are increasingly building their value based on ESG indicators, whereas investment firms are seen to use ESG results for portfolio management more commonly. The development of ESG has stimulated the creation of methods that enable its quantification. Consequently, the number of provided measures requires standardization and harmonization to support responsible investment and risk assessment. AI-based mechanisms can support the process of building a responsible ESG sector in terms of increasing trust in process management and minimizing potential risks associated with ESG management.

Research on ESG topics, risk management, and artificial intelligence is still relatively rare but seems to be developing and gaining importance. The introduction of artificial intelligence tools in ESG risk management can bring many benefits but also requires attention to potential threats and challenges associated with its implementation. One such challenge is, for example, ensuring the transparency of algorithms, which is particularly important in the context of risk assessment in ESG management.

Thanks to the application of machine learning and the analysis of large datasets, it is possible to conduct a more precise analysis and identification of ESG risks, allowing for more effective management. Additionally, artificial intelligence can help identify positive ESG factors, enabling investors to find companies with high social and environmental value and detect potential sources of profit.

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