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ESG AT THE FOUNDATION OF INDUSTRY 5.0 AND ITS IMPACT ON MANAGEMENT ACCOUNTING

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Abstract

In addition to the difficult and constantly changing economic conditions, accountability needs to change its approaches due to the introduction of new regulations. In the European Union, the burden on economic entities is caused by the most severe requirements for social and environmental responsibility, the circular economy and carbon footprint. All these prerequisites require the relocation of various industrial production to countries outside the EU and/or to other continents. At the same time, the regulatory requirements in question give rise to the processing of significantly more information from the reporting systems in enterprises. The processes require the creation of a different organization of financial and management accounting. This requires the use of management accounting tools more and more in the preparation of financial statements and the information to them. All regulations imposed to integrate ESG standards are based on the idea and concept of Industry 5.0

Keywords: *ESG, Management accounting, Digital transformation, alternative options, Industry 5.0*

1. Introduction

The regulatory framework in the European Union significantly outpaces the capabilities of economic entities to meet the requirements and reorganize both their production needs and the organization of their overall activities. The constantly changing requirements create a number of difficulties, thus creating real economic benefits from the regulations made is increasingly difficult. Paying attention to the Bulgarian economy in the last decade, first the changes with the carbon footprint are imposed, then the changes imposed by Industry 4.0 and the idea of a circular economy, the requirements for ESG standards and entry into the Eurozone. All these regulations require a significant organization of the reporting activity and the processing of a number of processes, which rather create an administrative burden in our economic reality. At the same time, on a global scale, these processes impose and start the process in the next transformation of the general accounting process. All social changes require a quick and adequate transition through the information provision processes, according to the needs of the various economic entities

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regardless of which sector of the economy they are in. The imposed changes mentioned above shape additional scientific research of a technological nature, which is part of the characteristics of Industry 5.0. This is precisely what gives rise to the rapid transition to the fifth industrial revolution, stepping on ESG standards. All these transformation processes directly affect the meaning and tasks of management accounting. Being at the end of the seventh stage of development of accounting, namely the convergence achieved through the International Financial Reporting Standards (IFRS), the process of the eighth stage begins - the reverse unification of financial and management accounting.

2. The essential specifics of ESG standards and their influence on the concept of Industry 5.0

Reporting on responsibility in various directions is a fundamentally new moment for economic entities. The processing of a large amount of non-financial information is the basis for the existence of modern information flows to all users. Thus, ESG standards largely regulate most internal reports, but also turn them into official information for all interested parties. For this reason, "ESG is a collective term for the impact of business on the environment and society, as well as how stable and transparent its management is in terms of company management, executive compensation, audits, internal control and shareholder rights. It measures how your business integrates environmental, social and governance practices into its activities, as well as your business model, its impact and its sustainability" (, British business bank, 2025). The aforementioned statement builds a modern business model that transparently takes into account the overall impact of management decisions on environmental footprints, management policies and social commitment. The significant changes require the coverage of a number of larger information flows, and it is worth noting that they are of a heterogeneous type. Undoubtedly, the industrial sector in which the business entity operates is also of great importance. Examples can be cited in the energy sector, where the main emphasis is on the ecological footprint they leave, and this is a key point in the financial statements.

It is essential and significant to link sustainability reporting to the standards already mentioned, because to a large extent they are linked. According to Radosveta Krasteva-Hristova et al.: "Sustainability reporting has become a cornerstone of modern corporate responsibility and strategic management, as an intersection of accounting, finance and management. Over the past two decades, organizations have faced increasing pressure from investors, regulators and other stakeholders to disclose their environmental, social and governance (ESG) results, adopt integrated reporting practices and move towards circular economy (CE) business models" (Krasteva-Hristova, R.,Papradanova, D., & Vechev, V. , 2025). There is a large number of requirements that must be met when disclosing activities in the current economic reality. Taken together, these requirements are a significant and administrative burden for financial and accounting departments. Each of the elements presented in the above opinion has its own characteristics and specific features. Undoubtedly, the use of ESG standards would help to fulfill the other requirements, but it is far from a single solution that helps to disclose sustainability and move towards a circular economy.

There is also scientific research that proves that ESG is at the heart of the creation of the concept of Industry 5.0. Yosumaz and Uzun conducted a scientific study and found that: "Industry 5.0 = Industry 4.0 + Environment + Employees and Society + Business Sustainability." The most important reason for expressing the components of the Industry 5.0 process as an equation is to reach the expression on the left side by studying the components on the right side" (Yosumaz, I., Uzun, H., , 2024). To all the changes that have occurred due to the concept of Industry 4.0, views on the impact on the environment, carbon footprints, etc. are gradually added. This again requires a change in the business models that a large part of economic entities profess. Organizing sustainability reporting is the last element in the transformation from Industry 4.0 to Industry 5.0. The transition to digitalization and robotization of a number of economic processes significantly helps to obtain additional information flows that are the basis for the disclosure of activities. According to Petya Petrova: "Sustainability reporting is a key tool for managing uncertainty because it provides transparency, accountability and reliable information on the environmental, social and governance (ESG) results of companies" (Petrova, 2024). A significant and key element that is highlighted is the possibility of reducing uncertainty. All prerequisites for this are established by the specified components of transparency and reliability of information. At the same time, it is necessary to point out that all these requirements are an administrative burden, which may not have positive effects for all economic entities. For enterprises that trade in international markets and wish to demonstrate sustainability in all the specified components, it is a fundamental factor. The benefits of all requirements are yet to be established, since a significant part of the environmental requirements are gradually falling out of the ESG concept initially introduced by the European Commission.

In this context, the following opinion is presented for better economic results. "Furthermore, demonstrating that the disclosure of ESG (environmental, social and governance) indicators and green innovations play a key role in corporate performance, suggesting that companies with more transparent sustainability practices tend to achieve better financial results" (Khanchel, I., Lassoued, N., & Baccar, I. , 2023). Flexibility in the use of standards is a key indicator of the possibility of changing economic perspectives on a national, European and global scale. The search for transparency in commercial practice has been a major moment since 2008, as analysts pointed out that the misunderstanding of a number of financial indicators confused investors and led to the financial and economic crisis. In the opinions presented, however, there is uncertainty about the actual manifestation of the mentioned standards as an opportunity for an effective way to maximize financial results. It is possible to state the following thesis that achieving better economic results is a consequence of flexibility in management decisions, and not so much because of taking sustainability into account and implementing its characteristics. There are economic sectors in which it is easier to reorganize all activities and implement a number of innovations and thus achieve effective results.

It is important for scientific research to analyze and present scientific views that address distrust in the implementation of ESG standards. Fong and Chen present the following opinion: "The complexity and costs associated with collecting ESG data pose additional challenges. Smaller companies often lack the financial and technical capacity to effectively collect and analyze ESG data" (Fong, A. K., & Chen, Y. , 2023). Fundamental to the current scientific research is also the consideration of the administrative burden and costs required to create the specified data. As already

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mentioned, not all economic entities bring effective solutions that improve the business environment. Much of the information needs to be collected in an analytical manner, which is not always organized when processing primary data. It is necessary to hire additional staff or increase costs for companies that use an external service for accounting activities. All this requires transformations that are complex and financially unprofitable for a part of the enterprises. It should not be overlooked that "although previous research has examined the impact of ESG reporting on financial performance and investment behavior, significant gaps remain regarding investors' perceptions of ESG disclosures and the specific challenges that companies face in reporting ESG factors. Research has largely focused on quantitative aspects of ESG factors, such as financial correlations and regulatory compliance, while qualitative analyses of investor confidence and corporate sustainability strategies have been relatively understudied" (Reverte, 2020). One of the significant and frequently used opinions is Reverte's, as it shows a more extensive and in-depth analysis of the implementation of ESG standards. Quantitative research and financial analyses do not have the tools to indicate the qualitative characteristics of the implementation and the difficulties that management teams face. It is very incorrect to use only one analysis and conclude that standards and sustainability reporting are a significant factor in economic efficiency. The few qualitative studies can hardly show the shortcomings of the standards and their weak points, indicated by the employees who are directly involved in their integration. This opinion also points out another important element, namely the trust of investors in the information presented in this way. The presence of all these additional analyses and compliance with all requirements is significant only if they are viewed with trust and are accepted as an important economic indicator. Such a study would show the real effect of the use of ESG standards and sustainability disclosure. It is for this reason that "future research should further explore local and industry-specific dynamics in order to improve best practices for disclosure of ESG issues" (Pratiwi, A, P., & Edeh, F, O. , 2024). Common European decision-making on these practices affects national economies differently. For this reason, economic indicators should be monitored by individual sectors for each individual country. In this case, it is possible to draw real conclusions and introduce good practices, because they can be differentiated by various characteristics such as: economic development, sectoral characteristics, etc.

In recent years and months, scientific opinions aimed at rethinking the relationship between these three letters E, S, G have been increasingly observed. "Despite being a major factor in the escalating problem related to climate change and social justice, their G scores are significantly higher than their E and S scores. They try to contribute to environmental and social well-being, but their actions do not justify their impact. This may be one of the reasons why risk factors have a negligible relationship with environmental and social factors, while showing a significant and negative relationship with the management factor" (Makkar, M.K.; Bhat, B.A.;Showkat, M.; Mabrouk, F. , 2025). The presented opinion is unconventional compared to a large part of the views on this topic, but it presents a view that directs researchers in a slightly different direction. States and their decisions, although aimed at improving life through the implementation of a number of environmental solutions, do not always achieve the desired effect. Thus, it is difficult to find a relationship between these three letters. Again, considerable attention has been paid to the fact that these requirements have a negative impact on management decisions. It is possible to highlight that the opinion presented in this way does not observe a significant relationship between the three factors – environmental, social and governance. While some countries are trying to introduce and comply with these requirements extremely strictly, others, due to economic development, significantly increase the use of coal, etc., draws attention to G. Muhammad Asif et al. deduce a specific framework of interaction between Industry 5.0 and ESG.

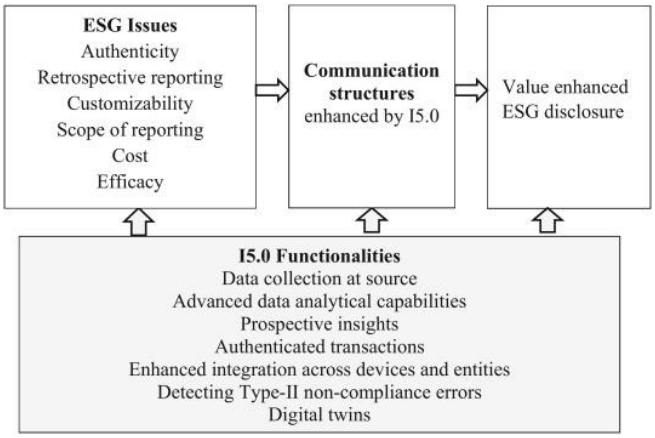

Figure 1: Industry 5.0 and ESG Framework (Asif, Muhammad & Searcy, Cory & Castka, Pavel, 2023)

Summarizing everything mentioned so far, it is possible to formulate the following opinion: "according to this perspective, Industry 5.0 integrates broad sustainable development goals into industrial development, especially environmental standards, sustainability and human-centeredness. Combining these main elements, the European Commission has imagined Industry 5.0 as a comprehensive framework that prioritizes public well-being, environmental protection and adaptability" (Ghobakhloo, M., Iranmanesh M., Fathi,M., Rejeb, A., Foroughi,B. , Nikbin, D., 2024). In this way, the thesis stated at the beginning of the scientific paper is proven that ESG standards are the basis for the development of Industry 5.0, since they aim to be comprehensive in economic processes. Through the main element of the fifth industrial revolution, namely robotization, the aim is to achieve significantly smaller ecological footprints, reduce carbon emissions and long-term sustainability of a number of activities. All of this is possible to achieve, but constant changes and uncertainty in economic conditions are factors creating administrative burden and even misunderstanding of these requirements.

There are also studies that highlight the possibility of using new reporting standards through the Industry 5.0 toolkit. The transition to ESG reporting based on I5.0 may require managing certain trade-offs, as the implementation of new technologies and requirements does not always initially bring benefits. The first is the (high) cost of Industry 5.0 compared to the possible value creation in terms of transparency, authenticity, real-time operation and personalization. The trade-off between cost and value will largely determine the extent of the diffusion of ESG reporting infrastructure based on Industry 5.0. When companies realize that the possible value creation exceeds the costs, the use of Industry 5.0 has a stronger business case. Second, data security versus trust between network partners is another consideration. The desire to create opportunities for co-creation of value while protecting and preventing data misuse remains a key consideration. (Asif, Muhammad & Searcy, Cory & Castka, Pavel, 2023) Analyzing the

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two directions mentioned above is an essential moment for achieving the goals of this type of disclosure. It is significant to conclude that ESG standards are at the heart of the existence of the fifth industrial revolution, but are also among the main tools that help in their implementation, disclosure and comprehensiveness.

3. The transformation of management accounting brought about by ESG standards

All the factors mentioned in the previous point and the critical analysis of the opinions, with the main aim of showing the importance of ESG standards on the processes related to management accounting. All changes on a global and/or national scale inevitably have an impact on reporting. This publication is limited to the impact on management accounting. All the changes mentioned in the introduction and the first point are directly related to this type of reporting, because additional information is required, which is processed and obtained through the tools of management accounting. In search of ecological and sustainable solutions, financial accounting is increasingly transformed into management accounting. The implementation of daily accounting activities, in the current economic reality, is far from sufficient. The main premise for unifying the two accounting, according to Guo, is because: "financial accounting is not enough for the sustainable development of enterprises that cannot meet the requirements of the time. Management accounting has become an inevitable product on the market, and this transformation is favorable for existing accountants to solve their own employment problems. Currently, the transformation from financial accounting to management accounting is in its infancy. Many problems inevitably arise in the transformation process" (Guo, 2019). The rapid change in regulatory requirements and the economic environment has a strong impact on financial accounting, which is increasingly unprepared for them. For this reason, management accounting, through its flexible tools and its adaptation to the environment, is increasingly used and integrated into economic entities. From this statement, it is possible to establish that the faster management accounting is established, the faster the set goals are achieved. Becoming an "inevitable" part of economic processes, it is being improved to meet the requirements. Thus, the general accounting process continues to retain a fundamental place in enterprises.

According to Liu: "As traditional financial accounting work has been largely replaced by artificial intelligence, the general trend is to shift to management accounting. Now more and more business managers are eager for management accountants to actively participate in the company's operations and decision-making to significantly increase the economic benefits and wealth creation of enterprises" (Liu, 2021). Digital transformations based on Industry 5.0 are at the core of current and future transformations related to accounting processes. Financial accounting has traditionally lost its relevance due to the ability of other solutions to perform its work. The main emphasis is on management accounting, as it complements information flows and increases the data it analyzes for the implementation of ESG and sustainability reporting. In continuation of the opinions presented, "accounting departments have also encountered financial robots that can provide efficient and accurate financial accounting in traditional financial accounting, ensuring maximum data accuracy, which has had a significant impact on traditional financial accounting departments. To do this, financial analysts who want to remain competitive in the era of artificial intelligence must constantly improve their global management potential and introduce innovations in management accounting" (Shutian, 2023). Modern conditions significantly change traditional perceptions of such traditional sciences as financial accounting. Significantly lagging behind, changing economic conditions require the organization of additional powers or the hiring of employees primarily engaged in management accounting. Competitiveness is a significant factor that requires maintaining advantages among all in the sector or in certain regions. Management decisions require more and more information, taking into account various constraints, such as ESG standards, the concept of the circular economy, carbon footprint and sustainability reporting. When considering all these components, building business strategies in the short, medium and long term is a serious challenge. Using the tools of management accounting is a possible solution to the requirements presented above.

A key point in "traditional financial accounting focuses mainly on financial reporting and compliance with tax requirements of enterprises. In today's information age, however, the demand for internal support for decision-making, performance management and other aspects is increasing. Based on this change, the transformation from financial accounting to management accounting has been promoted. Compared with financial accounting, management accounting pays more attention to internal operations and strategic decision-making and requires more flexible real-time data to assist managers in making accurate decisions" (X. Wang, 2020). Maintaining meaningful information flows that enable the implementation of economic goals for business entities is one of the great advantages of management accounting. Internal information flows need to be part of the real-time decision making concept, since decision-making is important to be timely. Processing competitive data is possible with the introduction of ESG standards, because information that is often considered internal is published. This is also the basis of the transformation process that has already begun from financial to management accounting.

In these transformation processes, it is necessary to completely change the concept of financial management, which may combine the two types of accounting. As "financial management is no longer easy to adapt to modern enterprise management standards, enterprises must also reform their management system, ensure that after the transformation, personnel and training will improve their own way of managing corporate information, so as to realize the change from financial accounting to management accounting and constantly improve the level of financial management of the enterprise, improving the competitiveness of the same enterprise" (Ye, 2019). Improving the same system is a continuous difficult and in some cases expensive process. However, in today's economic situation, this is more of an imperative than a choice. Large corporations without taking into account the impact on the environment and the changes imposed by Industry 4.0 and Industry 5.0 would not show corporate sustainability. Reforming real-time systems and building reporting systems to meet modern requirements needs to happen now in order to maintain the ability to both comply with regulatory guidelines and maintain market share.

In the context of the above, it is necessary to maintain the qualifications of personnel. "With the advancement of digital technologies, such as data analysis and automation, organizations

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now have increasingly sophisticated tools to support their strategic goals, which makes the role of management accountants more dynamic and essential for achieving business success" (Husain, F., Dungga, M. F., & Noholo, S. , 2024). The transformation processes already mentioned are directly aimed at the ability to use management accounting tools effectively. The human factor, despite the guidelines for its replacement with various digital solutions, remains just as significant and always determines the perspective of management decisions. Preparation is significant and organizationally necessary for successful business processes.

4. Conclusion

Economic transformations are a fundamental and leading process that predetermines new periods and challenges for economic entities. It is significant and important to study how they affect the organizational structure and behavior of economic entities, especially when they are imposed as regulatory regulations. Regardless of whether ESG standards, carbon footprint, circular economy or the concept of Industry 5.0, transformation is required, which does not always establish cost-effective solutions. The presented in this scientific paper, namely the administrative burden, additional costs and the processes of transition from financial to management accounting, create increasing difficulties for European enterprises. On the other hand, this strengthens the process of transformation and integration of different and sustainable models, with the clear goal of increasingly effective management decisions.

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