FINANCIAL INNOVATION AND SUSTAINABLE FINANCE – CHALLENGES AND PROBLEMS

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Abstract: *Transitioning to a sustainable future with inclusive, green economies, financial innovation and resilient ecosystems requires huge investments. The development of suitable framework conditions is a requirement for encouraging private financial market players towards sustainability. A key requirement for the development of a sustainable financial system is a uniform taxonomy of sustainability. Ongoing research highlights how the adoption of new technologies can contribute to improved environmental outcomes and it is also argued that investments by firms in sustainable strategies should generate positive returns in terms of competitivity The purpose of this article is to present the impact of evaluation of financial innovation in the context of sustainable development, the challenges of assessment of financial innovation in the process on management and analyses. The results of the study show that the findings confirm that green innovation is indeed an extremely complex phenomenon.*

Key words: *financial innovation, sustainable finance, challenges*

I. INTRODUCTION

The concept of sustainable finance represents measures and proposals to attract the financial sector to the green transformation: how to prioritize capital to investments for the development of a new type, a green economy, as well as for the greening of the traditional economy, including industrial production and the energy sector.

„Sustainable finance refers to the process of incorporating environmental, social and governance (ESG) considerations into investment decisions in the financial sector, leading to more long-term investment in economic activities and sustainable development projects“, the European Commission states on its dedicated page dedicated to sustainable finance.

During the new program period 2021-2028, a minimum of 30% of the budgets of the EU operational programs will be mandatorily directed to projects for sustainable development, and in the national recovery and sustainability plans, this percentage was increased to a mandatory minimum of 37%. Despite this massive public investment, the EU is running short of €180 billion a year to successfully meet its climate targets. According to the The National Development Programme BULGARIA 2030 (Bulgaria 2030, 2022) the main policy objective by 2030 is to accelerate the economic convergence with the EU standard, through targeted and focused government support for increasing specialisation in products and industries characterized by a high technological and research intensity. The implementation of the strategic goals is envisaged through targeted policies and interventions, grouped into five interconnected and integrated development axes: (1)

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Innovative and Intelligent Bulgaria; (2) Green and Sustainable Bulgaria; (3) Connected and Integrated Bulgaria; (4) Responsive and Just Bulgaria. The introduction of eco-innovation activities, including new eco-products and technologies, will play an important role in supporting businesses. At the same time, efforts will be made to create new jobs in the green and blue economy. Low resource efficiency will also be addressed through actions to reduce the amount of waste generated in the production process, including in the implementation of projects within the framework of public procurement and concessions.

The financial services landscape is undergoing a transformation with an increased focus on sustainability and innovative technologies. Investors are increasingly seeking to finance sustainable solutions. At the same time, sustainability frameworks and sustainability disclosures are becoming more robust as stakeholders intensify demands for greater transparency. A broadening spectrum of sustainability themes including biodiversity, transition, adaptation and inclusive finance are taking increasingly prominent roles, while the market for green, social, sustainability and sustainability-linked (GSSS) financial instruments continues to grow rapidly (Bank for International Settlements, 2023).

II. METHODOLOGY

The methodology used is based on general scientific methods of scientific knowledge - analysis, synthesis, induction and deduction, as well as on specific methods, specifically applying the systematic approach. The information base of this study is the results of research for the impact of evaluation of financial innovation in the context of sustainable development. This paper searches for answers to the following research question (RO):

- ✓ RQ: Does financial innovation affect sustainable finance?

On the basis of the obtained results, an assessment of the impact of financial innovation on sustainable finance.

III. LITERATURE REVIEW

This paper continues the ongoing active discussion in the modern literature on the issues of the influence of responsible innovations on risks to companies. The research papers differentiate between, on the one hand, „standard" investments in innovations— investments in simple innovations, the social implications of which may be anything and go beyond the area of responsibility of their companies, – and, on the other hand, investments in responsible innovations, investments in innovations, supplemented by investments in corporate social responsibility. The existing theoretical discussion on the topic of the sustainable development of companies is mainly focused on the experience of companies that function in the market environment with low and moderate risk. Here, the sustainable development of companies and their financial risks are differentiated. The sustainability of companies is measured from the perspective of the implementation of the SDGs, and financial risks are measured from the perspective of market capitalization. Responsible innovations are treated as a means of achieving the SDGs and sustainable development of companies. But to increase the market capitalization of companies (reduce their financial risks), it is preferable to implement „standard" innovations (Popkova et al., 2024).

In addition to providing higher-quality and lower-cost products and services, innovation is generally considered to be central to the efforts that are required to address the social and environmental challenges of the 21st century. However, the nature of the innovation process for sustainable development is acknowledged to be particularly complex, dynamic, and uncertain as it requires a combination of incremental and radical changes in organizations, markets, consumer behaviors and public policies. Ongoing

research highlights how the adoption of new technologies can contribute to improved environmental outcomes and it is also argued that investments by firms in sustainable strategies should generate positive returns in terms of competitivity. However, despite such promising research findings, the extent to which the innovation process itself can be considered to direct such efforts automatically in a way that is of benefit to society has been called into question. The complexity of defining and trying to ensure fairness in the application of artificial intelligence (Trabelsi et al., 2023).

The focus on IT companies in this paper was motivated by the high-risk framework. Responsible innovations in this specific sphere are determined as the use of the high-tech capabilities of IT companies to implement socially important innovation projects . Examples of responsible innovations of IT companies are the provision of expanded guarantees of the quality of high-tech services that are provided at electronic platforms by IT companies, the organization of remote employment for employees, and the organization of charity events that are promoted via their digital platforms. Analysis of IT companies can provide important ideas on the influence of corporate social responsibility on financial risk taking (Popkova et al., 2024).

Many studies have confirmed that the implementation of green innovation not only helps the environment, but also contributes to organizational performance, competitiveness, and corporate green image or brand. In addition, researchers are interested in the factors that affect green innovation, or its antecedents. Green innovation may involve the factors at different levels, and organization-level factors play a fundamental role in comparison with industry-, region-, and country-level factors. Organizational factors deserve close attention because the green innovation effort is never purely policy-driven, but a result of balancing between long-term sustainability and short-term profitability in managerial praxis (Yang et al., 2017).

IV. FINANCIAL INNOVATION AND SUSTAINABLE FINANCE

As is the case with the related issues of sustainable innovation and financial innovation discussed above, sustainable finance is a complex concept. It is polysemic, multifaceted, and characterized by the absence of consensus on its definition. This dearth of consensus is due to the scarcity of conceptual frameworks and the interchangeability of various terminologies to designate the same phenomena. This can also be attributed to the holistic and interdisciplinary

character of sustainable finance. Similarly, the evolution of this concept over time has contributed to the complexity of providing a unified and inclusive definition (Trabelsi et al., 2023).

The development of new technologies vastly transformed the financial sector, and climate risk management formed part of this transformation. In this respect, new technologies are changing practically all the links of the financial sector value chain and, in all of them, opportunities arise in which sustainability criteria may play an important role. However, it is important to note that the technological progress derived from the use of artificial intelligence techniques has a cost in terms of climate impact. The increasingly complex calibration of certain algorithms has a high carbon footprint, and this must be taken into account when analysing the optimum path to a low-carbon economy. This is particularly important for the financial sector, the activity of which has not had a significant carbon footprint up till now. However, the incremental use of cloud data storage services and of algorithm calibration by complex optimisation techniques may reverse this situation. (Alonso and Marqués, 2019).

There are different types of innovations towards sustainable development, such as: technological innovation, organizational innovation, institutional innovation and social innovation. Organizational innovation requires the integration of hardware (e.g., technological infrastructure) and software (e.g., organizational culture) resources in an organization to cope with different innovation types (e.g., radical vs. incremental) and modes (e.g., component vs. architectural). Therefore, green innovation is a complex organizational endeavor that has been examined in different contexts, such as green research and development, green supply chain management, green corporate image and green organizational identity (Yang et al., 2017). Technology plays a critical role in enabling sustainable finance to scale up climate action. Emerging technologies such as artificial intelligence (AI), blockchain, Internet-of-things (IoT), and sensor technologies are helping overcome challenges to scale up sustainable finance while enhancing accessibility, impact, and reach (Bank for International Settlements, 2023).

✓ AI, including machine learning and natural-language processing, enhance sustainability disclosures and assessments. It is important to think about the challenges and potential benefits that AI presents when offering answers to sustainability-related problems. One societal issue that artificial intelligence has the potential to solve is sustainability—his editorial deterioration and the urgent climate crisis present complex problems that call for cutting-edge, innovative solutions. It unlocks untapped value from vast amounts of data, helping pave the way for more comprehensive and rapid implementation and adoption of green and sustainability frameworks and practices worldwide. Predictive modeling techniques, fueled by machine learning, can help develop risk models that take into account sustainability-related risk factors. They can also help address gaps in sustainability disclosures by using AI simulations to forecast potential outcomes that may otherwise not be evident. AI can also be used to detect inconsistencies in company disclosures with other data sources to address greenwashing concerns. These data-driven approaches provide a stronger foundation for more informed sustainability-related decision-making and capital mobilization (Bank for International Settlements, 2023).

✓ Blockchain technologies support sustainable finance by improving data transparency, making assertions non-repudiable and detecting inconsistencies in disclosures. In the realm of finance, blockchain technology has emerged as a powerful tool for driving sustainable practices and advancing environmental and social goals. Blockchain digital identities and self-executing smart contracts add the ability to streamline consensus among parties undertaking climate finance workflows from verification of ESG metrics to creation of new sustainable finance products. Solutions using blockchain capabilities fortify investor and market confidence through prevention of greenwashing, heightened transparency, efficiency, security, traceability, and accountability. Blockchain offers much value to sustainable finance because it can track emissions and lay the foundation for better accountability and traceability of transactions in this industry. Besides, numerous blockchain-based projects emerged today to reduce carbon emissions and introduce innovative financial technology for emissions tracking and credit trading.

✓ IoT and sensor technologies, which may also include spatial information technology and satellite remote sensing, enhance data collection and enable ongoing monitoring and reporting of sustainability-related metrics. Climate-relevant data collected from IoT devices and sensor telemetry are being used to assess and verify the impact of sustainability projects at scale. They prove to be especially useful in improving data collection accuracy, enabling proactive risk management, and improving compliance with

sustainability requirements, thereby speeding up the transition towards a carbon-neutral economy and adaptation to climate change (Bank for International Settlements, 2023). IoT and AI technologies have the potential to revolutionize green finance by enabling financial institutions to gather and analyze vast amounts of data from various sources, providing valuable insights into the sustainability performance of companies, projects, and investments.

The introduction of innovative technologies enhances corporate sustainability reporting. For example, blockchain and IoT technologies are being used to create secure registries of both regulations as well as compliance, resulting in enhanced transparency improving auditability of data. AI solutions are augmenting sustainability reporting and helping increase adoption of standards in sustainable finance, unlock the value of vast troves of unstandardized sustainability data, and automate sustainability reporting across numerous existing frameworks, requirements, and standards. Green culture and green IS provides the social environment and technological infrastructure necessary for green innovation, the success of which largely depends on how well the two types of resources meet its requirement. In this sense, fit-as-matching gives appropriate theoretical mechanism and analytical scheme to conceptualize and operationalize the alignment among them, as depicted in Figure 1.

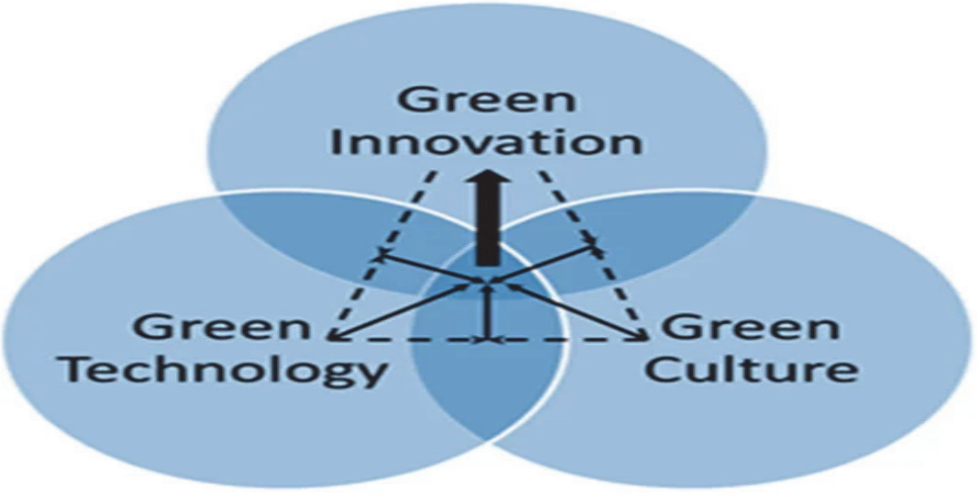

Fig.1. *Relationship between financial innovation and sustainability finance*

Source: Yang el al., 2017

The introduction of eco-innovation activities, including new eco-products and technologies, will play an important role in supporting businesses. At the same time, efforts will be made to create new jobs in the green and blue economy. Low resource efficiency will also be addressed through actions to reduce the amount of waste generated in the production process, including in the implementation of projects within the framework of public procurement and concessions (Velinova-Sokolova,2022).

In March 2022 the Bulgarian Stock Exchange and its daughter company Financial Market Services in partnership with the leading carbon accounting and decarbonisation

software solutions provider Plan A launched Oxygen initiative. The initiative is first of its kind in Bulgaria and aims to enable Bulgarian companies to measure and report on their environmental, social, and corporate impact by obtaining an assessment of their carbon footprint as well as further ESG-related indicators. One of the advantages of Oxygen, especially for public companies, is the ability to generate the Non-Financial Declaration, which has been developed in accordance with the EU Taxonomy and includes the ESG indicators established in world practice. The generated declaration contains quantitative and qualitative information structured textually and graphically in three main parts – environmental, social and corporate governance. This facilitates public companies as much as possible, especially in the reporting period (BSE,2022).

In August the Bulgarian Stock Exchange announced it has adopted Refinitiv's Environment, Social and Governance (ESG) metrics to power its sustainability index set to be launched end of 2022. Refinitiv, a London Stock Exchange Group business, will manage and provide data on the sustainable performance of BSE listed companies. Refinitiv's ESG metrics will qualify the constituents of BSE's ESG Index and maintain BSE's planned sustainability index.

Bulgarian Stock Exchange following the mission to promote responsible investment in sustainable development and advance corporate performance on environmental, social and governance factors in Bulgaria, together with Idependant Bulgarian Energy Exchange take the initiative of the establishment of Green Finance & Energy Centre - a NGO that concentrates the efforts of the business, the state and other stakeholders towards sustainable development of the country.

Green Centre aims at establishing itself as a think tank for policies in the fields of sustainable finance and energy with the following objectives:

- ✓ To give the topics of sustainable finance and energy top priority among decision-makers in the business and the country.
- ✓ To be a unifying factor and to lead the public debate on the topics of sustainable finance and energy in Bulgaria.
- ✓ To participate in the development of policies in the field of sustainable finance and energy.
- ✓ To take part, representing Bulgaria, in the European and global networks for sustainable finance and energy.
- ✓ To generate ideas for developing an index methodology, financial instruments based on sustainability factors.
- ✓ To promote the ideas among stakeholders and the public through various trainings, seminars, discussions and other initiatives (BSE,2022).

V. CHALLENGES AND PROBLEMS

Sustainable development represents a way for the company to stand out and stay ahead of the competition, a strategic choice around which a great opportunity for value creation is offered to the company. Indeed, the strategic challenge is to transform the constraints and threats related to the application of such a strategy into opportunities, thanks to innovation, which is then seen as the necessary means for the company to develop a competitive advantage based on corporate social responsibility (Mahcine and Cherchem, 2020).

Potential challenges or limitations of using financial innovation in ESG reporting:

1. **Data privacy concerns:** IoT technology involves collecting and transmitting large amounts of data, which raises concerns about data privacy and security. Companies must

ensure adequate data protection measures to prevent data breaches or unauthorised access to sensitive information.

2. **Cost implications:** Implementing innovative technology in ESG reporting can be expensive, as it requires significant investment in devices, software, and infrastructure.
3. **Complexity**: financial innovative technology can be complex and challenging to implement, particularly for companies with limited technical expertise. Companies must clearly understand their ESG reporting requirements and the technology they need to implement to ensure a successful implementation.
4. **Integration with existing systems:** IoT technology must be integrated with a company's existing systems, including accounting and reporting systems, to ensure that data is accurately collected and analysed. This can be a complex and time-consuming process (AYR International, 2023).
5. **The IoT is a technological development** that makes it possible to connect many different machines that collect data in real time and respond to specific problems.

Three problem statements have been developed along the theme of scaling up climate action through advancing innovative technology solutions in sustainable finance (see table 1).

Table 1. Innovative technology solutions in sustainable finance

Innovative Technology	**Problems**	**Solutions**
AI Technology	How can we increase adoption of standards in sustainable finance using AI technology?	✓ AI tools to enable financial institutions, asset managers, and investors; ✓ Unstandardised sustainability data; ✓ Use data sources to comply with disclosure, standard, and taxonomy-related requirements;
Blockchain Technology	How can we ensure data integrity in sustainable finance using blockchain technology to increase investor and market confidence?	✓ Procedures for transparency, traceability, and accountability; ✓ Enable efficient auditing processes; ✓ Mechanism for increase speed and reduce costs;
IoT	How can we enhance data collection in sustainable finance using IoT and sensor technologies for monitoring and capturing data?	✓ Ensure informed assessments of impact, risk and compliance; ✓ Analysis, and reporting of sustainability metrics in sustainable finance; ✓ Proactive risk management;

Source: prepare by the author on the base Bank for International Settlements, 2023

Finance is designed to tackle the challenges of economic recovery in ways that help not only reduce risks and vulnerabilities to the economy but also reduce the emissions that cause climate change and increase development uncertainty. In the financial industry, data deployment and collection is becoming key, and the only thing that matters are whether the financial product that real customers want can be delivered in sufficient green packaging and adequate liquidity.

VI. CONCLUSION

Emerging technologies continue to enable and scale sustainable finance. AI's ability to comprehend, learn from and provide insights from massive amounts of data, enhances sustainability disclosures and assessments, and streamlines the adoption of green frameworks. Blockchain technologies streamline data integrity and transparency – preventing greenwashing in sustainable finance transactions facilitated by digital identities and smart contracts for complex counterparty workflows. IoT technologies produce critical sensor telemetry for AI driven learning systems, enabling real-time monitoring and reporting of sustainability metrics, enhancing data accuracy, proactive risk management, and compliance with sustainability requirements (Yang et al., 2017). The financial sector plays a key role in this challenge, firstly because of its exposure and the consequent capital shocks if this risk crystallises, and secondly because it has the task of channelling the funds needed to transform our economy into a sustainable one. The financial authorities are fully conscious of this and are engaged in a lively discussion of measures recognising the specific importance of climate change as a risk factor in the financial sector. Climate change, along with new technologies, has unquestionably become a key driving factor of the transformation of the financial sector.

Even though relevant research is still in its infancy, the integration of blockchain technology gives academics a larger mental space and a greater variety of research topics. The business and services of blockchain will be further extended by the incorporation of further emerging technologies, resulting in an expansion of integration options. Financial innovative technology has the potential to revolutionise ESG reporting by providing real-time, data-driven insights into a company's sustainability practices.

The findings confirm that green innovation is indeed an extremely complex phenomenon. For an organization to succeed in achieving the ecological goals, it must establish sufficient green AI infrastructure, and align it with the endeavor. In addition, it must consider the existing organizational culture and cultivate new green culture. Organizations of different sizes may pursue different strategies to align green culture with green innovation and green AI infrastructure.

Today, IoT is helping organisations to be more sustainable not only in the streamlining of data collection but also by delivering positive social and environmental impact in the management of water resources and reduction of gas and energy expenditures. IoT has made renewable energy easy to use for businesses, government organisations, and even the general public in their individual homes.

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