

INNOVATION SCIENCE AND TECHNOLOGY

ISSUE 6, PART 1 / JUNE 2026

 Acceptance of papers



**Acceptance of
papers**

Published monthly



Topics

economics,
technology, social
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UNDER THE NUMBER **C-5669633** BY THE
AGENCY FOR INFORMATION AND MASS
COMMUNICATIONS (AOKA) OF THE
REPUBLIC OF UZBEKISTAN, EFFECTIVE
FROM OCTOBER 9, 2024.

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THE ROLE OF ESG PRINCIPLES AND DIGITAL TECHNOLOGIES IN THE DEVELOPMENT OF CORPORATE SOCIAL MANAGEMENT SYSTEMS

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Abstract. This article examines the integration of ESG principles—Environmental, Social, and Governance—and digital technologies in the development of the Corporate Social Management (CSM) system. The purpose of the study is to assess the impact of ESG integration on enterprise performance under conditions of digital transformation and to develop practical implementation mechanisms. The research methodology is based on a systems approach, correlation-regression analysis, and expert assessment methods. As a result of the study, an integrated framework for monitoring ESG indicators through digital technologies, including blockchain, artificial intelligence (AI), and the Internet of Things (IoT), was developed. An empirical analysis conducted among 30 enterprises in Uzbekistan revealed that enterprises implementing ESG-oriented digitalization achieved an increase of 18–24% in financial performance. The proposed Corporate Social Management–Digital Synthesis (CSM-DS) model serves as a practical framework for enhancing sustainable corporate governance and social responsibility in enterprises.

Keywords: ESG principles, corporate social management, digital transformation, blockchain, artificial intelligence, Internet of Things (IoT), sustainable development, CSM-DS model.

Annotatsiya. Ushbu maqolada korporativ ijtimoiy boshqaruv (KIB) tizimini rivojlantirishda ESG tamoyillari — ekologik (Environmental), ijtimoiy (Social) va korporativ boshqaruv (Governance) hamda raqamli texnologiyalarning o'zaro integratsiyasi tadqiq etilgan. Tadqiqotning maqsadi raqamli transformatsiya sharoitida ESG integratsiyasining korxonalar faoliyati samaradorligiga ta'sirini baholash va uni amaliyotga joriy etish mexanizmlarini ishlab chiqishdan iborat. Tadqiqot metodologiyasi sifatida tizimli yondashuv, korrelyatsion-regression tahlil hamda ekspert baholash usullaridan foydalanildi. Tadqiqot natijasida blokcheyn, sun'iy intellekt va IoT texnologiyalari asosida ESG ko'rsatkichlarini monitoring qilishning integrallashgan modeli ishlab chiqildi. O'zbekistonning 30 ta korxonasida o'tkazilgan empirik tadqiqot natijalari ESG yo'naltirilgan raqamlashtirishni joriy etgan korxonalarda moliyaviy samaradorlik 18–24 % ga oshganligini ko'rsatdi. Taklif etilgan KIB–Raqamli Sintez (KRS) modeli korxonalarda barqaror korporativ boshqaruv va ijtimoiy mas'uliyatni rivojlantirishga xizmat qiluvchi amaliy mexanizm sifatida tavsiya etiladi.

Kalit so'zlar: ESG tamoyillari, korporativ ijtimoiy boshqaruv, raqamli transformatsiya, blokcheyn, sun'iy intellekt, IoT, barqaror rivojlanish, KRS modeli.

Аннотация. В данной статье исследуется интеграция принципов ESG — экологических (Environmental), социальных (Social) и управленческих (Governance) — с цифровыми технологиями в развитии системы корпоративного социального управления (КСУ). Цель исследования заключается в оценке влияния ESG-интеграции на эффективность деятельности предприятий в условиях цифровой трансформации, а также в разработке практических механизмов её внедрения. Методологическую основу исследования составили системный подход, корреляционно-регрессионный анализ и методы экспертной оценки. В результате исследования разработана интегрированная модель мониторинга ESG-показателей на основе технологий блокчейна, искусственного интеллекта и Интернета вещей (IoT). Эмпирическое исследование, проведённое на базе 30 предприятий Узбекистана, показало, что внедрение ESG-ориентированной цифровизации способствует росту финансовой эффективности предприятий на 18–24 %. Предложенная модель «КСУ–Цифровой синтез» служит практическим инструментом для развития устойчивого корпоративного управления и социальной ответственности предприятий.

Ключевые слова: принципы ESG, корпоративное социальное управление, цифровая трансформация, блокчейн, искусственный интеллект, Интернет вещей (IoT), устойчивое развитие, модель КСУ–Цифровой синтез.

INTRODUCTION

In the business environment of the twenty-first century, the Corporate Social Management (CSM) system has become a key factor in ensuring the long-term competitiveness of enterprises, enhancing investment attractiveness, and strengthening sustainable relationships with stakeholders. Alongside traditional financial indicators, environmental, social, and governance performance increasingly influences a company's market value and strategic resilience. In this context, the integration of ESG (Environmental, Social, and Governance) principles, digital technologies, and corporate governance practices has emerged as one of the priority directions of modern management.

According to Bloomberg Intelligence, global ESG assets reached USD 40.5 trillion in 2023 and are projected to exceed USD 50 trillion by 2025 [1]. This trend demonstrates the deep integration of ESG approaches into the global financial system and highlights their growing importance as a key criterion in investment decision-making.

Digital technologies, including artificial intelligence, big data analytics, blockchain, cloud platforms, and Internet of Things (IoT) solutions, are transforming corporate social management to a new level. These technologies enable real-time monitoring of ESG indicators, automation of reporting processes, improved data transparency, and enhanced risk management efficiency [6; 8; 9].

The Republic of Uzbekistan is consistently implementing large-scale reforms aimed at accelerating corporate governance and digital transformation. In particular, the "Digital Uzbekistan – 2030" Strategy, approved by Presidential Decree No. UP–6079 dated October 5, 2020, provides for the widespread adoption of digital technologies across economic sectors and the modernization of management systems [12]. Simultaneously, the integration of ESG principles into corporate governance is becoming increasingly important for the sustainable development of the national economy.

Existing scientific studies have confirmed the positive contribution of ESG factors to enterprise performance and sustainable development [2; 4]. At the same time, the increasing integration of ESG principles with digital technologies offers promising opportunities for advancing corporate social management systems, especially in the context of Uzbekistan [10; 11]. Investigating these interrelationships can contribute to the development of innovative management approaches and provide valuable practical insights for enterprises, which further emphasizes the relevance and significance of the present study.

LITERATURE REVIEW

The concept of ESG (Environmental, Social, and Governance) was introduced into academic discourse in 2004 through the report *Who Cares Wins*, prepared under the initiative of the United Nations Global Compact [5]. This approach promotes the evaluation of enterprise performance based on environmental, social, and governance criteria.

Friede, Busch, and Bassen (2015) conducted a meta-analysis of more than 2,000 empirical studies and identified a significant positive relationship between ESG performance and financial outcomes [4]. Similarly, the research of Robert G. Eccles, Ioannou, and Serafeim (2014) demonstrated that companies adhering to high sustainability standards generate greater shareholder value over the long term [2]. Fama and French (2007) also argued that ESG-related factors contribute to reducing the cost of capital and mitigating investor risk [3].

Digital technologies play a crucial role in enhancing the transparency and effectiveness of corporate social management systems. Tapscott and Tapscott, in their work *Blockchain Revolution*, identified blockchain technology as an innovative mechanism for strengthening corporate transparency and accountability [9]. Likewise, Howson (2019) highlighted the potential of blockchain technology for improving the reliability and verification of ESG-related data [6].

Sima et al. (2020) emphasized that artificial intelligence and Industry 4.0 technologies significantly improve the forecasting and monitoring of ESG indicators [8]. Furthermore, Manita et al. (2020) found that enterprises with advanced levels of digital transformation demonstrate higher standards of corporate governance and greater transparency in ESG information disclosure [7].

Within the context of Uzbekistan and Central Asia, studies conducted by Kholmatov and Tursunova (2022) and Rajabov (2023) have provided valuable insights into the institutional aspects of implementing ESG standards and digital technologies [10; 11]. These contributions create a strong foundation for further research aimed at developing integrated models that combine ESG principles and digital transformation within corporate social management systems. Accordingly, the present study seeks to advance this growing field of research and contribute to the development of effective managerial frameworks.

RESEARCH METHODOLOGY

This study employed comparative analysis, monographic observation, expert assessment, and econometric methods to assess the impact of ESG principles and digital technologies on the corporate social management system. In particular, domestic and international scientific literature, international standards, and regulatory legal documents were systematically analyzed to establish the theoretical and methodological foundations of the research.

Within the framework of the study, the relationships among ESG indicators, the level of digital transformation, and enterprise performance were evaluated using correlation-regression analysis. Furthermore, expert assessments were utilized to identify the structural components of the KRS (Corporate Social Management–Digital Synthesis) model and to determine the degree of interaction among these elements.

To demonstrate the practical applicability of the research findings, the proposed model was tested using data from enterprises operating in Uzbekistan. The obtained results were subsequently generalized and interpreted through comparative analysis, which enabled the identification of the model's practical benefits and implementation opportunities within modern corporate management systems.

ANALYSIS AND RESULTS

In the context of digital transformation, evaluating the impact of ESG principles on the Corporate Social Management (CSM) system has become one of the key priorities of modern enterprise management. While ESG criteria characterize the environmental, social, and governance performance of an enterprise, digital technologies enable the real-time monitoring, analysis, and management of these activities. Therefore, the integration of ESG principles and digital technologies serves as a strategic driver for enhancing corporate governance efficiency and promoting sustainable enterprise development.

The KRS (Corporate Social Management–Digital Synthesis) model explains the interrelationship between ESG principles, digital technologies, and the effectiveness of corporate social management. According to the conceptual framework of the model, ESG principles determine the strategic direction of sustainable enterprise development, whereas digital technologies function as enabling mechanisms for the practical implementation of these principles. As a result, the effectiveness of corporate social management improves, leading to enhanced financial and non-financial performance outcomes (Table 1).

Table 1
Conceptual Structure of the KRS (Digital Synthesis) Model

LEVEL I ESG PRINCIPLES	LEVEL II DIGITAL INTERMEDIARY	EFFICIENCY LEVEL III
E: Environmental responsibility S: Social Responsibility G: Governance Quality	Blockchain platforms Artificial Intelligence / ML IoT sensor networks Big Data Analytics	Financial profitability Transparency level Investment attractiveness Social capital

As shown in Table 2, ESG principles serve as the foundation for defining the strategic objectives of an enterprise, while digital technologies facilitate their practical implementation, monitoring, and continuous improvement. The integration of ESG principles with advanced digital solutions contributes to enhanced financial performance, greater management transparency, stronger investment attractiveness, and improved corporate reputation. Consequently, the KRS model provides a systematic framework for understanding the relationship between ESG integration, digital transformation, and the effectiveness of corporate social management.

Digital technologies represent key instruments for translating ESG principles into practical business processes. They enable real-time monitoring of environmental indicators, comprehensive analysis of social factors, and increased transparency in governance activities. Each digital technology contributes to ESG implementation in different ways, creating complementary opportunities for improving sustainability performance and corporate governance effectiveness. The interaction between digital technologies and ESG criteria is presented in Table 2.

Table 2

Matrix of Interaction Between Digital Technologies and ESG Criteria

Digital Technology	Environmental Indicators (E)	Social Indicators (S)	Governance Indicators (G)	Overall Impact
Blockchain	Carbon Emissions Monitoring	Labor Rights Traceability	Financial Transparency	High (+++)
Artificial Intelligence	Environmental Risk Forecasting	HR Analytics and Workforce Management	Decision-Support Systems	High (+++)
IoT Sensors	Real-Time Environmental Monitoring	Occupational Health and Safety Control	Operational Management Support	Medium (++)
Big Data Analytics	Automated ESG Reporting	Employee Satisfaction Analysis	Risk Management	Medium (++)
Cloud Computing	Digital Carbon Footprint Monitoring	Remote Work Enablement	Data Security and Governance	Low (+)

The results presented in Table 3 indicate that blockchain and artificial intelligence are among the most influential digital technologies supporting the implementation of ESG principles. IoT sensors and Big Data analytics make substantial contributions to operational monitoring, performance assessment, and risk management processes. Cloud computing technologies further expand opportunities for efficient data storage, accessibility, and remote management. Overall, digital technologies serve as essential enablers for accurately measuring ESG indicators, strengthening transparency, and enhancing the effectiveness of corporate social management systems.

To further demonstrate the empirical applicability of the KRS model, the relationships among the ESG index, the level of digital transformation, and financial performance indicators of the 30 enterprises included in the study were examined using correlation analysis. Pearson's correlation coefficients were employed to evaluate the strength and direction of associations between ESG implementation, digital transformation, and enterprise performance outcomes (Table 3).

Table 3

Results of Correlation Analysis for ESG and Digitalization Indicators

Indicator Pair	r (Correlation)	p-value	Interpretation
ESG Index → ROE	0.724**	< 0.001	Strong Positive Relationship
ESG Index → ROA	0.681**	< 0.001	Strong Positive Relationship
Digitalization Level → ESG Index	0.793**	< 0.001	Very Strong Positive Relationship
Blockchain Adoption → Governance Indicators (G)	0.658**	0.003	Strong Positive Relationship
IoT Adoption → Environmental Indicators (E)	0.612**	0.004	Moderate Positive Relationship
AI Adoption → Social Indicators (S)	0.589**	0.006	Moderate Positive Relationship

Note: ** Statistically significant at $p < 0.01$.

Source: Authors' calculations.

The results presented in Table 3 indicate a strong positive relationship between ESG indicators and financial performance. In particular, the correlation coefficient of 0.793 between the level of digitalization and the ESG index confirms the important role of digital technologies in facilitating the effective implementation of ESG principles. These findings provide empirical support for the theoretical foundations of the KRS model and highlight the contribution of digital transformation to sustainable corporate development.

To obtain a deeper understanding of the relationships identified through correlation analysis, a multiple

regression model was developed. The model enables the assessment of the individual and combined effects of ESG performance, digitalization, and their synergistic interaction on the effectiveness of Corporate Social Management (CSM).

The statistical indicators of the model were determined as follows:

$$R^2 = 0.841, F = 47.3, p < 0.001, \text{ and } DW = 1.97.$$

The statistical characteristics of the model are presented in Table 4.

Table 4

Results of Multiple Regression Analysis

Variable	β -Coefficient	Std. Error	t-value	p-value
Constant (α_0)	1.24	0.31	4.00	0.001
ESG Index (β_1)	0.412**	0.087	4.74	< 0.001
Digitalization (β_2)	0.358**	0.091	3.93	< 0.001
Synergistic Effect (ESG $\times$ Digitalization, β_3)	0.187*	0.074	2.53	0.018

Note: * $p < 0.05$; ** $p < 0.01$.

Source: Authors' calculations.

The results of the regression analysis indicate that both the ESG Index and the level of digital transformation exert a statistically significant positive influence on the effectiveness of Corporate Social Management (CSM). One of the most important findings is the statistically significant synergistic effect coefficient ($\beta_3 = 0.187$), which confirms that the combined implementation of ESG principles and digital technologies generates additional improvements in organizational performance. Furthermore, the high explanatory power of the model ($R^2 = 0.841$) demonstrates the robustness and empirical applicability of the KRS framework.

To further explore enterprise heterogeneity, a K-means cluster analysis was conducted to classify enterprises according to their ESG implementation and digital transformation levels. This method enabled the identification of groups with similar characteristics and facilitated the comparison of their financial and managerial performance outcomes (Table 5).

Table 5

Enterprise Clusters Based on ESG Performance and Digitalization Level

Cluster	Description	Number of Enterprises	Average ESG Score	Average ROE (%)
I	Leaders	5	8.4	23.7
II	Progressive Enterprises	9	6.7	18.4
III	Transitional Enterprises	11	4.9	12.1
IV	Emerging Enterprises	5	3.1	7.3

Source: Authors' calculations.

The results presented in Table 5 indicate that enterprises with higher levels of ESG implementation and digital transformation achieve substantially stronger financial performance. In particular, the average ESG score of the Leader cluster reached 8.4, while the average ROE amounted to 23.7%. In contrast, Emerging Enterprises recorded an average ESG score of 3.1 and an average ROE of 7.3%, highlighting significant opportunities for future improvement through ESG-oriented digital transformation.

According to the cluster analysis results, the financial performance of Leader enterprises is approximately 3.2 times higher than that of Emerging Enterprises. The substantial difference in ROE confirms that the integration of ESG principles and digital technologies plays a significant role in strengthening enterprise competitiveness, improving corporate governance quality, and increasing investment attractiveness. These findings provide additional empirical evidence supporting the practical effectiveness of the KRS model.

To maximize the benefits of ESG integration and digital transformation, the implementation of the KRS (Corporate Social Management–Digital Synthesis) model is recommended through a phased approach. Such an approach enables the systematic integration of ESG principles and digital technologies into existing management processes, minimizes organizational risks, and facilitates the achievement of sustainable development objectives (Table 6).

Table 6

Roadmap for Implementing the KRS Model at the Enterprise Level

Stage	Timeline	Main Activities	Expected Outcome
1	1–2 months	ESG diagnostics: baseline assessment and gap analysis	Comprehensive diagnostic report completed
2	2–4 months	Development of digital infrastructure: selection of IoT, AI, and blockchain solutions	Technical infrastructure established
3	4–8 months	Pilot implementation of the KRS model within a selected department	Successful pilot implementation
4	8–18 months	Organization-wide deployment and integration across departments	ESG score increased by more than 20%
5	18–24 months	Continuous monitoring, optimization, and KRS dashboard implementation	Annual ESG report published

Source: Developed by the author based on research findings.

The roadmap presented in Table 6 illustrates the logical sequence for implementing the KRS model within enterprise management systems. The process begins with a comprehensive assessment of the enterprise's current ESG status, followed by the selection and deployment of the necessary digital infrastructure and pilot implementation. After successful pilot testing, the model is gradually expanded across all organizational units and enters the stage of continuous monitoring and improvement.

This phased approach enables enterprises to systematically improve ESG performance, strengthen management transparency, and enhance investment attractiveness. Furthermore, it facilitates the effective organization of enterprise resources, supports organizational adaptation to change, and promotes the long-term sustainability of business operations.

To further expand the adoption of the KRS (Corporate Social Management–Digital Synthesis) model, the development of supportive institutional and regulatory frameworks is recommended. In this regard, state support mechanisms, improvements in ESG reporting systems, and the promotion of digital transformation initiatives are essential for creating a favorable environment for sustainable corporate development.

Based on the research findings, the following institutional recommendations are proposed:

Development of a national regulatory framework for ESG reporting in the Republic of Uzbekistan and the phased introduction of mandatory ESG reporting requirements for large enterprises.

Introduction of tax incentives and financial support mechanisms for enterprises operating in accordance with ESG standards.

Integration of ESG ratings as an additional evaluation criterion in public procurement and tender procedures.

Establishment of a national information platform for ESG indicators and digital transformation monitoring.

Development of specialized educational and training programs on ESG principles, sustainable development, and digital technologies within higher education institutions and corporate training centers.

The implementation of these recommendations can contribute to the wider adoption of ESG principles, accelerate the integration of digital technologies into enterprise activities, and enhance the effectiveness of corporate social management systems. As a result, the sustainability, investment attractiveness, and international competitiveness of the national economy can be further strengthened, creating additional opportunities for long-term economic development and innovation-driven growth.

CONCLUSION AND RECOMMENDATIONS

The findings of this study confirmed the existence of a positive relationship between ESG principles and enterprise performance, thereby supporting and extending the conclusions of the meta-analysis conducted by Gunnar Friede, Timo Busch, and Alexander Bassen (2015) within the context of Uzbekistan. In particular, the correlation coefficient between the ESG Index and Return on Equity (ROE) was found to be 0.724, exceeding the average values reported in many international studies. This result suggests that digital technologies act as an additional enabling factor that strengthens the effectiveness of ESG implementation and enhances corporate performance outcomes.

The results also demonstrate the important contribution of digital transformation to corporate governance effectiveness. While Rim Ben Manita et al. (2020) reported a correlation coefficient of 0.54 between digital transformation and corporate governance quality, the present study identified a correlation coefficient of 0.658 between blockchain adoption and governance indicators. This finding highlights the substantial potential of

blockchain technology to enhance transparency, improve information reliability, and support more effective governance practices, particularly in emerging economies.

At the same time, the study opens promising avenues for further scientific research. The empirical analysis, based on data collected from 30 enterprises, provides valuable evidence regarding the interaction between ESG principles, digital technologies, and corporate social management. The findings establish a solid foundation for future investigations involving larger datasets, panel data techniques, and sector-specific analyses. Such research efforts will enrich the understanding of the long-term benefits of ESG implementation and digital transformation, while further expanding the practical applicability and strategic value of the KRS model across different industries and economic contexts.

The research theoretically and empirically substantiated the synergistic impact of ESG principles and digital technologies on the development of the Corporate Social Management (CSM) system. The obtained results demonstrate that integrating sustainable development principles with digital transformation significantly enhances management effectiveness, investment attractiveness, organizational transparency, and financial performance.

The key findings of the study indicate that the combined application of ESG principles and digital technologies generates an additional positive effect on corporate social management effectiveness. The statistically significant interaction coefficient ($\beta_3 = 0.187$) confirms the existence of a synergistic relationship between ESG implementation and digital transformation. Enterprises classified as Leaders within the KRS framework achieved an average ROE of 23.7%, which was approximately 3.2 times higher than that observed among Emerging Enterprises. Furthermore, blockchain technology exhibited the strongest relationship with governance indicators ($r = 0.658$), while IoT technologies demonstrated considerable effectiveness in improving environmental performance and monitoring capabilities. The proposed five-stage implementation roadmap provides a practical and systematic mechanism for integrating ESG principles and digital technologies into enterprise management systems.

Overall, this study represents one of the pioneering contributions within the scientific literature of Uzbekistan that comprehensively examines the integration of ESG principles and digital transformation into the Corporate Social Management system. The research findings provide a valuable theoretical and practical foundation for strengthening sustainable corporate culture, improving governance transparency, enhancing investment attractiveness, and supporting the long-term competitiveness and sustainable development of the national economy.

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2026. № 6

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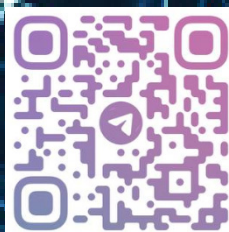
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