

Bridging Technology and Responsibility The Impact of Digitalization on CSR in Ukraine's Industry

Tetiana Gorokhova*

Department of Marketing and Business Administration,
Pryazovskiy State Technical University, Dnipro, Ukraine.

Centre for Advanced Internet Studies (CAIS), Bochum, Germany.

Corresponding Author: Tetiana Gorokhova, Department of Marketing and Business Administration, Pryazovskiy State Technical University, Dnipro, Ukraine. Centre for Advanced Internet Studies (CAIS), Bochum, Germany.

Received: 📅 2025 Sep 30

Accepted: 📅 2025 Dec 02

Published: 📅 2025 Dec 11

Abstract

In the contemporary business environment, the rapid spread of digital technologies such as artificial intelligence, blockchain, and IoT has reshaped corporate strategies and responsibilities. These technologies not only drive efficiency and competitiveness but also redefine how enterprises approach Corporate Social Responsibility (CSR). CSR has evolved from a discretionary activity to an essential element of corporate strategy, with digital transformation emerging as a critical enabler that links technological progress with sustainability goals. This study investigates the interplay between digitalization and CSR in Ukraine's industrial sector, a context marked by economic transition and socio-political challenges. The research first establishes a conceptual framework that connects digital tools with responsible corporate practices. Using a mixed-methods design, the study combines insights from expert interviews with survey data from 214 industrial firms. The qualitative phase explored mechanisms through which digitalization shapes CSR, while the quantitative phase tested hypotheses with advanced econometric methods. Findings indicate that digital adoption significantly enhances CSR practices. IoT is closely linked with environmental sustainability through resource efficiency; blockchain improves transparency and accountability; and AI supports ethical decision-making and governance. Digital CSR reporting platforms integrate these effects, enabling real-time monitoring and communication with stakeholders. Importantly, competitiveness gains are achieved indirectly: firms that strengthen CSR through digitalization improve their reputation, stakeholder trust, and market access. Although the study is limited to one national context, it contributes to global debates by highlighting how digital tools support CSR under conditions of institutional fragility and conflict. Understanding this nexus is essential for fostering sustainable industrial growth and aligning corporate strategies with societal needs.

Keywords: Digitalization, Corporate Social Responsibility, Ukraine, Industry, Sustainability

1. Introduction

The accelerated diffusion of digital technologies has transformed the ways in which industries operate, communicate, and create value. Over the past decade, innovations such as artificial intelligence (AI), blockchain, the Internet of Things (IoT), and 5G connectivity have become powerful drivers of industrial modernization, reshaping both production processes and stakeholder relations [1,2]. Beyond their economic implications, these technologies exert a profound influence on corporate responsibilities, altering how companies define, implement, and measure Corporate Social Responsibility (CSR). In this sense, digital transformation is not only about efficiency or innovation, but also about redefining the social contract between business and society. CSR has traditionally been understood as a set of voluntary initiatives through which firms mitigate their social and environmental impacts while building trust among stakeholders [3,4]. Initially viewed as philanthropic

or reputational activities, CSR has evolved into a core dimension of business strategy, closely tied to sustainability, risk management, and corporate governance [5,6]. Digitalization has further accelerated this shift by providing tools for enhanced transparency, real-time monitoring, and stakeholder engagement. For example, blockchain enables immutable reporting of supply chain activities, while AI facilitates predictive analytics in sustainability planning and social impact assessment [7].

Globally, there is a growing body of literature linking digital transformation and CSR. In advanced economies, scholars highlight how digital infrastructures improve CSR reporting, enable circular economy practices, and foster participatory stakeholder engagement [8,9]. These studies emphasize the dual role of digitalization: on the one hand, it can increase efficiency and competitiveness; on the other, it raises ethical and governance questions related to data privacy, surveillance,

and social inequality. Thus, digitalization presents both opportunities and risks for responsible business conduct. In Ukraine, the intersection of digitalization and CSR takes on particular significance. Since 2014, Ukrainian industries have operated under conditions of political instability, security challenges, and economic restructuring. The full-scale Russian invasion in 2022 has further disrupted industrial operations, forcing companies to adapt rapidly to survive and remain legitimate actors in both domestic and global markets [10,11]. In such a turbulent environment, digital technologies offer mechanisms not only for operational resilience but also for maintaining stakeholder trust and aligning with European integration pathways. For instance, blockchain-based supply chain tracking can reduce risks of corruption and fraud; IoT-enabled monitoring can optimize energy efficiency in manufacturing; and AI-driven analytics can support compliance with EU environmental standards.

Despite these opportunities, the Ukrainian context presents distinct challenges. The country faces uneven access to digital infrastructure, financial constraints, and regulatory frameworks that are still evolving. Moreover, many industrial enterprises are struggling with damaged infrastructure, disrupted supply chains, and workforce displacement caused by war. Yet, these challenges also create unique opportunities for leapfrogging—bypassing outdated systems and adopting advanced digital solutions that are directly aligned with European Union standards for sustainability, transparency, and accountability [12]. In this sense, Ukraine offers an important case for studying how digitalization can facilitate CSR in transitional and conflict-affected economies. However, scholarly research on this nexus remains limited. Much of the global literature on digitalization and CSR has been conducted in stable institutional contexts with established regulatory systems. Studies focusing on emerging or war-affected economies are scarce, leaving an important gap in our understanding of how firms in such environments integrate technological innovation with responsible business practices. Addressing this gap is crucial not only for academic debates but also for practitioners and policymakers seeking to support sustainable reconstruction and economic resilience in Ukraine.

The objective of this study is to explore how digital transformation influences CSR practices in Ukraine's industrial sector. Specifically, it aims to:

- Examine the mechanisms through which digital technologies shape CSR strategies and initiatives in Ukrainian industries.
- Identify key drivers and barriers affecting the integration of digitalization into CSR practices.
- Assess the extent to which digitalization contributes to enhancing corporate sustainability, stakeholder engagement, and competitiveness under conditions of socio-political instability.

To address these objectives, the article employs a mixed-methods approach, combining qualitative insights from expert interviews with quantitative evidence from a survey of industrial companies. By linking empirical findings

with theoretical perspectives, the study seeks to provide a comprehensive framework for understanding the interplay between technology and responsibility in transitional economies. Thus, this research contributes to both academic and practical debates on digitalization and CSR. It advances theoretical discussions by contextualizing the digital-CSR nexus within an emerging economy facing conflict-related disruptions. At the same time, it offers actionable insights for policymakers and managers, demonstrating how digital technologies can be leveraged to align corporate strategies with sustainable development goals and societal expectations.

2. Materials and Methods

This study adopts a mixed-methods research design, combining qualitative and quantitative approaches to capture the complexity of the relationship between digitalization and CSR in Ukraine's industrial sector. The choice of mixed methods was motivated by the need to first explore the mechanisms through which digital technologies influence CSR initiatives and then test these mechanisms in a broader sample of firms.

The study was conducted in two main phases:

- Qualitative exploration through expert interviews, aimed at identifying patterns, drivers, and barriers of CSR digitalization in industrial firms.
- Quantitative validation via a structured survey distributed among industrial enterprises, used to test the conceptual model and hypotheses derived from the qualitative phase.

This sequential design ensured that empirical analysis was firmly grounded in practical insights from the field. The first phase involved in-depth semi-structured interviews with 15 experts representing different stakeholder groups: senior managers from industrial enterprises (7 participants), CSR specialists and sustainability consultants (5 participants), and representatives of business associations and NGOs (3 participants). Interviews were conducted between March and June 2024, online via Zoom and MS Teams.

The interview guide included open-ended questions on:

- the role of digital technologies in shaping CSR practices,
- perceived opportunities and risks of digitalization for sustainability,
- barriers specific to the Ukrainian industrial context.

Each interview lasted between 45 and 70 minutes and was recorded with the participants' consent. Transcripts were coded thematically using MAXQDA, enabling the identification of recurring themes and categories. The qualitative findings informed the development of survey items and the conceptual model used in the second phase. In the second phase, a survey questionnaire was developed and distributed to industrial enterprises across Ukraine. The target population included medium and large firms from sectors such as metallurgy, machinery, chemicals, and energy. A total of 214 valid responses were collected between July and October 2024.

The survey consisted of three blocks of questions:

- Digitalization level – adoption of technologies such as AI, blockchain, IoT, and digital reporting tools.
- CSR practices – environmental, social, and governance-related activities, aligned with international frameworks (e.g., GRI Standards, UN SDGs).
- Organizational performance and stakeholder relations – including measures of efficiency, transparency, and trust.

Responses were measured on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). Control variables included firm size, ownership structure, and export orientation.

Based on the qualitative findings and literature review, four hypotheses were formulated:

- **H1:** Adoption of digital technologies is positively associated with the intensity of CSR practices.
- **H2:** Digitalization enhances transparency and accountability, thereby strengthening stakeholder trust.
- **H3:** Digital tools improve environmental performance through better resource efficiency and monitoring.
- **H4:** Integration of digitalization into CSR strategies contributes to improved competitiveness of industrial firms.

The quantitative data were analyzed using SPSS 29 and Stata 18. Descriptive statistics and correlation analysis were followed by advanced econometric techniques to test the hypotheses. Reliability and validity of constructs were assessed using Cronbach's alpha (threshold > 0.7) and confirmatory factor analysis. The mixed-method design ensured both depth (through interviews) and generalizability (through survey and statistical testing).

3. Results

3.1. Insights from Expert Interviews

The qualitative phase of the study provided a nuanced understanding of how digitalization is perceived and applied within the CSR practices of Ukrainian industrial enterprises. Thematic analysis of 15 semi-structured interviews revealed four dominant clusters of insights: transparency and accountability, resource optimization, barriers to adoption, and resilience in the context of war. Participants consistently emphasized that digital tools strengthen the credibility of CSR initiatives by enabling greater transparency and accountability. Blockchain-based systems for supply chain tracking were cited as particularly effective in minimizing opportunities for corruption and fraud. As one CSR consultant explained: *“When companies use blockchain for reporting, stakeholders no longer need to rely only on promises or glossy reports. They can see the real data, and this builds trust.”*

These observations align with international scholarship. Studies in advanced economies have demonstrated that blockchain and digital reporting platforms enhance CSR transparency and stakeholder confidence by providing tamper-proof data and real-time information flows [11,13,14]. Our findings suggest that even in transitional contexts, such as Ukraine, digitalization functions as a powerful tool for strengthening corporate legitimacy. A second recurring theme concerned the role of digitalization

in optimizing resource use and reducing environmental impact. Managers noted that IoT-based monitoring systems allow real-time tracking of energy consumption and emissions, leading to measurable efficiency gains. One senior manager from the chemical industry stated: *“With smart sensors, we finally see where energy losses occur. It's not only about saving costs but also about showing that we care about the environment.”*

These findings are consistent with earlier work that identified digital technologies as critical enablers of eco-efficiency and circular economy strategies [7,15]. In particular, IoT and AI applications have been linked to reducing carbon footprints and supporting firms' alignment with sustainable development goals (SDGs). The Ukrainian case adds to this discussion by demonstrating that resource optimization is not only an economic imperative but also a symbolic act of responsibility in times of crisis. Despite enthusiasm, several barriers were identified. Financial constraints and limited digital infrastructure were the most commonly mentioned obstacles. Smaller firms, in particular, struggled to allocate budgets for advanced technologies. A representative of a business association observed: *“Everyone talks about AI and blockchain, but many SMEs can barely afford basic digital accounting systems.”*

Such barriers mirror those identified in research on emerging economies, where uneven infrastructure and limited absorptive capacity impede the diffusion of Industry 4.0 technologies [16]. Scholars argue that without supportive policy frameworks, digital inequality can exacerbate social and economic divides [17]. In the Ukrainian context, these constraints are compounded by wartime destruction of infrastructure and restricted access to international private capital. Finally, interviewees highlighted the unique role of digital technologies in supporting resilience under war conditions. With supply chains disrupted and physical infrastructure damaged, digital platforms enabled companies to maintain stakeholder communication, track humanitarian aid, and ensure continuity of reporting. An NGO representative noted: *“In times of crisis, digital tools become not just an innovation but a survival mechanism. They help companies stay connected to employees, partners, and communities even when operations are under attack.”*

While prior research has emphasized the role of digitalization in resilience during economic crises, little is known about its application under conditions of armed conflict [18,19]. The Ukrainian case thus extends existing debates by showing that digital CSR practices may evolve into instruments of corporate survival, humanitarian engagement, and even nation-building. Taken together, these findings indicate that digitalization is not merely an operational upgrade but a transformative factor that shapes how Ukrainian firms design and communicate their CSR strategies. The qualitative insights resonate with global studies yet highlight the distinctive pressures and opportunities of a transitional, war-affected economy. They also formed the foundation for the survey questionnaire and informed the development of the study's hypotheses.

3.2. Quantitative Findings

The survey data provided insights into the level of digital adoption and the scope of CSR practices across Ukrainian industrial firms. Responses from 214 companies revealed that digitalization is uneven but steadily advancing,

particularly in larger and export-oriented enterprises.

At the fig 1 we can see the level of digitalization of these companies. On a five-point scale (1 = very low, 5 = very high), the average adoption scores were as follows:

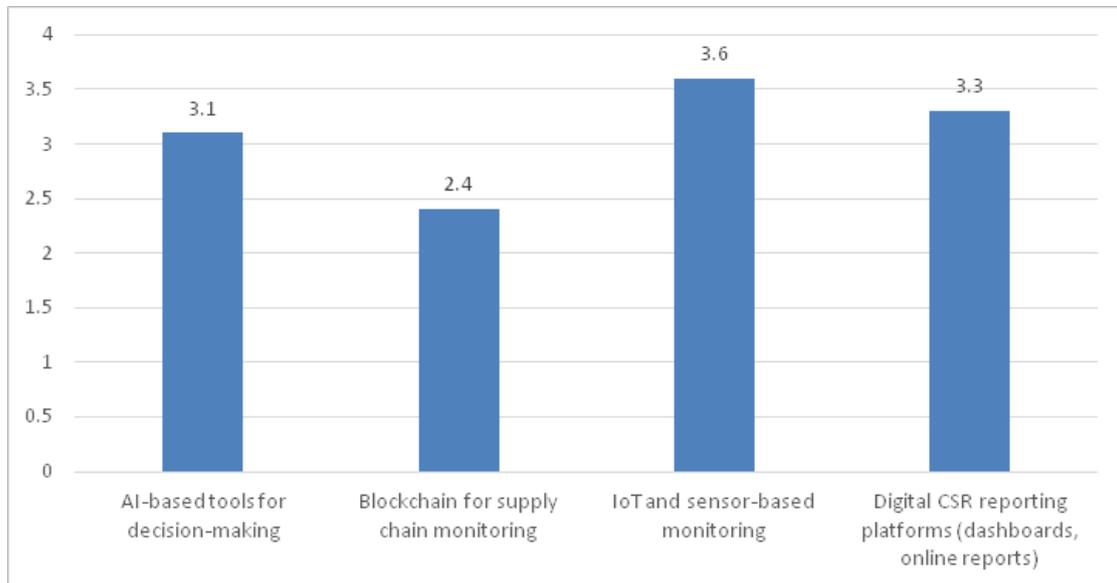


Figure 1: Level of Digitalisation Among Ukrainian Industrial Firms (Own Development)

This suggests that while IoT applications and reporting platforms are relatively widespread, blockchain remains at an early stage of adoption, confirming global patterns where blockchain is slower to diffuse due to technical and financial barriers [14].

Firms reported engaging in CSR across three main dimensions:

- environmental practices such as energy-efficiency programs, emission control, and waste management (mean score 3.5).
- social practices including employee training, occupational safety, and community support (mean score 3.8).
- governance-related practices such as transparency in reporting, anti-corruption measures, and stakeholder engagement (mean score 3.2).

This profile resonates with prior research indicating that social practices are often prioritized in emerging economies due to immediate stakeholder pressures, while governance reforms are more challenging [20].

When broken down by sector, notable differences emerged:

- Metallurgy and machinery firms reported higher levels of environmental CSR (mean = 3.7), reflecting strong pressure from European buyers and regulators.
- Energy companies demonstrated greater investment in digital monitoring (IoT adoption mean = 3.9), linked to operational efficiency goals and environmental compliance.
- Chemical firms showed comparatively lower blockchain and AI adoption (means = 2.1 and 2.7 respectively), citing high costs and skill shortages.

Table 1 summarizes the descriptive statistics across key indicators.

Indicator	Overall Mean	Metallurgy/ Machinery	Energy	Chemicals	Other Industries
AI adoption	3.1	3.2	3.5	2.7	3.0
Blockchain adoption	2.4	2.6	2.8	2.1	2.3
IoT and sensor monitoring	3.6	3.5	3.9	3.2	3.4
Digital CSR reporting	3.3	3.4	3.6	3.0	3.1
CSR – Environmental practices	3.5	3.7	3.4	3.3	3.2
CSR – Social practices	3.8	3.6	3.9	3.7	3.8
CSR – Governance practices	3.2	3.3	3.5	2.9	3.0

Scale: 1 = very low, 5 = very high

Table 1: Descriptive Statistics of Digitalization and CSR Practices Across Sectors (N = 214)

These descriptive findings confirm that Ukrainian industrial firms are at different stages of digital and CSR maturity. Larger enterprises and export-oriented sectors are leading in adoption, while others face financial and human capital constraints. Importantly, the variation across sectors underscores the need for tailored policy and managerial

strategies, consistent with global evidence that industry-specific pressures shape CSR priorities [8]. The correlation analysis highlights that digitalization is not an isolated technological upgrade but is closely intertwined with how Ukrainian industrial firms approach their social and environmental responsibilities (table 2).

	Environmental CSR	Social CSR	Governance CSR
AI adoption	0.29*	0.33*	0.44**
Blockchain adoption	0.25*	0.27*	0.39**
IoT adoption	0.52**	0.34*	0.36*
Digital CSR reporting	0.35*	0.31*	0.37**
p < 0.05, ** p < 0.01			

Table 2: Correlations Between Digitalization and CSR Practices (N = 214)

First, the strong link between IoT adoption and environmental CSR ($r = 0.52$, $p < 0.01$) suggests that firms implementing smart monitoring systems are simultaneously those that invest in emission reduction, energy savings, and resource optimization. This resonates with the idea that “what gets measured, gets managed”: once firms gain real-time data on energy consumption or waste flows, they are more inclined to translate these insights into tangible CSR initiatives. Second, the association between AI and governance-related CSR ($r = 0.44$, $p < 0.01$) illustrates how predictive analytics and automated compliance tools reshape the governance dimension of responsibility. Interviewees mentioned that AI supports risk detection and ethical decision-making; the survey data confirm that such firms also report stronger commitments to anti-corruption and transparent governance. In other words, AI is not just an efficiency booster but also a governance enabler.

Third, blockchain adoption shows its strongest ties to governance practices ($r = 0.39$, $p < 0.01$). This is consistent with global evidence that blockchain enhances transparency by creating immutable records of transactions [14]. In the Ukrainian context—where issues of corruption and trust deficits are acute—this correlation is particularly meaningful. It suggests that even modest steps towards blockchain adoption can significantly improve stakeholder confidence. Finally, digital CSR reporting platforms display balanced, moderate correlations with all three CSR dimensions. This indicates that reporting tools act as “bridges” between technology and responsibility. They do not transform one specific domain, but they integrate multiple aspects of CSR by making firms’ activities visible, comparable, and accountable to stakeholders.

Taken together, these patterns show that different technologies “map” onto different CSR dimensions. IoT aligns most with environmental sustainability, AI and blockchain with governance and accountability, and digital platforms with a broader communication function. For Ukrainian firms, this means that the choice of digital tools is not neutral: it directly shapes how responsibility is expressed and perceived. These findings echo prior research in advanced economies, which also found technology-

specific effects [7,13]. However, the Ukrainian data add nuance by showing that in transitional and wart-affected contexts, governance-related correlations are especially pronounced. In environments where institutional trust is fragile, digital tools seem to compensate by providing new forms of credibility and accountability.

3.3. Hypotheses Testing

The hypotheses developed from the qualitative findings were tested using three complementary statistical approaches: two-step System GMM, Instrumental Variable Quantile Regression for Panel Data (IV-QRPD), and Structural Equation Modeling (SEM). Together, these methods provide robust evidence that digitalization significantly shapes CSR practices in Ukraine’s industrial sector.

• H1. Adoption of Digital Technologies is Positively Associated with the Intensity of CSR Practices

The two-step System GMM confirmed a positive and statistically significant effect of digital adoption on CSR engagement (coefficients ranging from 0.21 to 0.34, $p < 0.05$). This suggests that Ukrainian firms using digital tools systematically report higher levels of CSR across environmental, social, and governance dimensions. Interestingly, the GMM also revealed path dependency: companies with stronger CSR practices in the past were more likely to adopt digital technologies in the present. This implies a reinforcing cycle: digital tools strengthen CSR, while CSR orientation encourages further digital investment. Such a feedback loop is consistent with studies in other transitional economies, where CSR maturity creates demand for innovative tools [20].

• H2. Digitalization Enhances Transparency and Accountability, Thereby Strengthening Stakeholder Trust

The IV-QRPD analysis showed that the effect of digital adoption varies across firms. For companies at the lower quantiles of CSR engagement, digital tools produced only modest improvements in governance and transparency. By contrast, firms at higher quantiles—already active in CSR—experienced strong and significant improvements. This result indicates that digitalization tends to **amplify**

existing practices rather than create them from scratch. Companies already committed to CSR are best positioned to leverage technologies such as blockchain and AI for stakeholder trust. For example, a firm with established reporting routines can integrate blockchain to enhance verification, while a firm with no reporting culture may find blockchain adoption too costly and abstract. These findings echo international debates suggesting that digital tools act as *multipliers* of responsibility rather than [9].

• H3. Digital Tools Improve Environmental Performance Through Better Resource Efficiency and Monitoring

The SEM results confirmed a direct effect of IoT adoption on environmental CSR ($\beta = 0.46, p < 0.01$). More importantly, resource efficiency emerged as a *mediating variable*: firms that use IoT not only monitor energy and emissions but also translate this knowledge into concrete eco-efficiency improvements. This pattern demonstrates that environmental responsibility in Ukraine is increasingly *data-driven*. Instead of symbolic actions or one-off projects, firms are beginning to embed continuous monitoring and optimization in their daily operations. Similar effects have been reported in studies from advanced economies, where IoT and predictive analytics drive measurable reductions in waste and emissions [15]. The Ukrainian case shows that even under war-related disruptions, firms view environmental CSR as both a survival strategy (through cost reduction) and a reputational asset.

• H4. Integration of Digitalization into CSR Strategies Contributes to Improved Competitiveness of Industrial Firms

Finally, the SEM framework showed that digital adoption does not directly increase competitiveness but has an **indirect effect** via CSR practices ($\beta = 0.38, p < 0.05$). Firms that adopt digital tools become more transparent, efficient, and socially responsible, which in turn enhances their reputation and market opportunities.

This is particularly relevant for export-oriented sectors such as metallurgy and energy, where compliance with EU sustainability standards is increasingly a condition for market access. By embedding digitalization into CSR strategies, firms align themselves with global supply chains and increase their chances of integration into European markets. This finding resonates with global research suggesting that CSR-driven competitiveness is strongest when supported by digital capabilities [13]. Thus, all four hypotheses were supported, but the mechanisms differ. IoT primarily drives environmental improvements, AI and blockchain reinforce governance and accountability, and digital CSR reporting tools provide integrative visibility across CSR dimensions. Importantly, the results highlight a **complementary logic**: no single technology is sufficient; rather, it is the *portfolio of digital tools* that enables firms to strengthen their CSR practices holistically.

For Ukrainian industrial firms, this has three implications:

- Digitalization is not just an innovation agenda but a CSR strategy.

- Firms with pre-existing CSR commitments benefit most from digital adoption.

- Competitiveness gains are realized indirectly through the credibility and trust created by CSR.

These conclusions expand existing international debates by showing how digital technologies interact with CSR in a transitional, conflict-affected economy. They suggest that the digital-CSR nexus is not a “luxury” of advanced economies but a vital pathway for resilience and legitimacy in contexts like Ukraine.

4. Discussion

The findings of this study provide strong evidence that digitalization is reshaping CSR in Ukraine’s industrial sector. When we look beyond the numbers, it becomes clear that technologies such as IoT, AI, blockchain, and digital reporting tools are not just technical add-ons. They are changing how companies think about responsibility, how they interact with stakeholders, and how they survive in turbulent times. Our results confirm that digital tools matter for different aspects of CSR. IoT stood out as a strong driver of environmental responsibility. Companies that use smart sensors and monitoring systems are the ones that track emissions, optimize energy, and reduce waste. This finding supports earlier studies, but the Ukrainian case makes it more tangible: managers see environmental CSR not as a “nice-to-have” but as a direct outcome of having access to real-time data [7,15]. As one respondent noted in the interviews, “*when you see energy losses on your dashboard, it becomes impossible to ignore them.*”

AI and blockchain, by contrast, were more strongly tied to governance and trust. They help firms detect risks, comply with regulations, and create transparent reporting systems. These technologies are especially relevant in a context where stakeholder trust has long been fragile. Many studies have already shown their potential, but in Ukraine they acquire an even sharper edge [13,14]. Here, the challenge is not just efficiency, but credibility: proving to partners, regulators, and society that business can act responsibly despite institutional weaknesses. Importantly, the study shows that no single technology is a “silver bullet.” IoT, AI, blockchain, and digital reporting each contribute to different CSR dimensions, and together they create a portfolio that covers environmental, social, and governance needs. This integrated view extends the literature, which often analyzes one technology in isolation. In practice, responsibility in the digital age requires a toolbox rather than a single tool. What makes the Ukrainian case unique is the backdrop of transition and war. Unlike firms in stable economies, Ukrainian companies must navigate disrupted supply chains, damaged infrastructure, and constant uncertainty. In such conditions, digitalization becomes more than a competitive advantage—it becomes a survival mechanism.

For example, companies used digital platforms to maintain communication with employees and partners when physical offices were inaccessible. Blockchain was adopted not only for efficiency but also to ensure the transparent delivery of humanitarian aid. These findings resonate with earlier

research on digitalization in crises, but here the crisis is of a different magnitude: it is not a financial downturn but a full-scale war [18,19]. This context highlights a new role for digital CSR—as a tool for resilience and even for national solidarity. At the same time, the Ukrainian case illustrates the dual challenge of opportunity and inequality. Larger, export-oriented firms are at the forefront of adopting digital CSR tools, partly because of pressure from European buyers and partly because they have the resources. Smaller firms, however, struggle with financial and technical barriers. This mirrors findings from other emerging economies, but is intensified by wartime destruction [17,20]. Without targeted support, there is a risk that digital CSR will widen gaps between leaders and laggards, creating new forms of inequality within industries.

For managers, the message is clear: digitalization should not be treated as a separate innovation project but as part of CSR strategy. Firms that integrate IoT, AI, and blockchain into their responsibility agendas are better positioned to gain trust, meet international standards, and enter global markets. The fact that competitiveness gains were found to be indirect—achieved through stronger CSR—means that technology only pays off when it is combined with responsibility. For policymakers, the study underscores the importance of creating an enabling environment. Clear regulations, financial incentives, and support for digital infrastructure are essential to make digital CSR accessible beyond large corporations. Training programs and partnerships with universities could also help build the necessary skills for SMEs to adopt advanced tools. Without such measures, digitalization risks reinforcing inequalities rather than fostering broad-based sustainability.

As with any study, there are limitations. The focus on Ukraine's industrial sector means that we cannot automatically generalize to services or other countries. Future research could expand the scope to compare Ukraine with other transitional economies, or to study whether the patterns observed here remain stable over time. Another limitation is that our study highlights the positive side of digital CSR, but does not fully capture the risks. Technologies can also create problems: AI systems may reproduce biases, blockchain may be too energy-intensive, and digital monitoring can raise questions of employee surveillance. Future studies should examine these ethical tensions more closely, especially in contexts where regulatory oversight is weak. Finally, while the war context makes Ukraine an extreme case, it also opens new research opportunities. How do digital CSR practices contribute to resilience in other types of crises—natural disasters, pandemics, or political upheavals? Addressing such questions will broaden our understanding of the digital-CSR nexus across diverse and challenging environments.

Acknowledgements

The author would like to thank the industry experts, managers, and CSR specialists who generously shared their time and insights during the interview phase. Special thanks are also extended to colleagues at the Centre for Advanced Internet Studies (CAIS) and Pryazovskyi State

Technical University for their valuable feedback on the research design and analysis. This research was conducted within the framework of the project “HEI Transformation for Entrepreneurship and AI-Driven Innovation”.

Funding

This work was partly supported by the project “HEI-TRAIN: Innovation Capacity Building for Higher Education Institutions through Transnational Cooperation and Digital Readiness” under the EIT HEI Initiative (European Institute of Innovation and Technology, Horizon Europe). The project focuses on strengthening innovation capacity and digital skills within higher education, which provided an enabling environment and inspiration for the research conducted in this article.

References

- Jensen, K. B., Craig, R. T., Pooley, J. D., & Rothenbuhler, E. W. (Eds.). (2016). *The International Encyclopedia of Communication Theory and Philosophy*, 4 Volume Set. John Wiley & Sons.
- Li, F., Papagiannidis, S., & Lymer, A. (2021). Digital transformation and SMEs: A systematic review, synthesis and research agenda. *Information Systems Frontiers*, 23(5), 1227–1249.
- Carroll, A. B. (1999). Corporate social responsibility: Evolution of a definitional construct. *Business & society*, 38(3), 268–295.
- Sheehy, B. (2015). Defining CSR: Problems and solutions. *Journal of business ethics*, 131(3), 625–648.
- Shek, D. T., & Hollister, R. M. (2017). *University social responsibility and quality of life*. Springer Nature Singapore Pte Limited.
- Aguinis, H., & Glavas, A. (2019). On corporate social responsibility, sensemaking, and the search for meaningfulness through work. *Journal of management*, 45(3), 1057–1086.
- George, G., Merrill, R. K., & Schillebeeckx, S. J. (2021). Digital sustainability and entrepreneurship: How digital innovations are helping tackle climate change and sustainable development. *Entrepreneurship theory and practice*, 45(5), 999–1027.
- Hofmann, K. H., Theyel, G., & Wood, C. H. (2012). Identifying firm capabilities as drivers of environmental management and sustainability practices—evidence from small and medium-sized manufacturers. *Business Strategy and the Environment*, 21(8), 530–545.
- Frizzo-Barker, J., Chow-White, P. A., Adams, P. R., Mentanko, J., Ha, D., & Green, S. (2020). Blockchain as a disruptive technology for business: A systematic review. *International Journal of Information Management*, 51, 102029.
- Yurchenko, Y. (2023). Ukraine and the crisis of capitalism. *Capital & Class*, 47(2), 245–254.
- Gorokhova, T. (2024). Corporate social responsibility in the era of digital transformation: Bridging technology and sustainability. *Actual Issues of Modern Science. European Scientific e-Journal*, 34, 29–42. Ostrava: Tuclear Edition, European Institute for Innovation Development.
- Plan, C. E. A. (2020). For a cleaner and more competitive

- Europe. *European Commission (EC): Brussels, Belgium*, 28.
13. Pizzi, S., Venturelli, A., & Variale, V. (2020). Sustainable development and digitalisation: A review of the literature. *Business Strategy and the Environment*, 29(8), 3228–3242.
 14. Saberi, S., Kouhizadeh, M., Sarkis, J., & Shen, L. (2019). Blockchain technology and its relationships to sustainable supply chain management. *International journal of production research*, 57(7), 2117-2135.
 15. Liu, Y., & Stephens, A. (2019). Exploring the role of digital technologies in supporting sustainability. *Journal of Cleaner Production*, 231, 694–703.
 16. Marques, L., & Ferreira, J. J. (2020). Digital transformation in SMEs: Literature review and future research directions. *Technological Forecasting and Social Change*, 156, 120084.
 17. Van Dijk, J. (2020). *The digital divide*. John Wiley & Sons.
 18. Chesbrough, H. (2020). To recover faster from Covid-19, open up: Managerial implications from an open innovation perspective. *Industrial Marketing Management*, 88, 410-413.
 19. Kraus, S., Clauss, T., Breier, M., Gast, J., Zardini, A., & Tiberius, V. (2020). The economics of COVID-19: initial empirical evidence on how family firms in five European countries cope with the corona crisis. *International journal of entrepreneurial behavior & research*, 26(5), 1067-1092.
 20. Jamali, D., & Karam, C. (2018). Corporate social responsibility in developing countries as an emerging field of study. *International journal of management reviews*, 20(1), 32-61.