Journal of Economic and Leadership
Volume. 2 No. 1 March 2025
e-ISSN : 3048-3387, p-ISSN : 3048-3395, Page 43-66
DOI: https://doi.org/10.70142/jbl. v2i1.61
Available online at : https://jurnal-jbl.stiekasihbangsa.ac.id/index.php/jbl/

Environmental Management Control Systems and Blockchain Adoption: A Systematic Literature Review on Their Impact on Environmental Performance and Reputation

Novrizal[1], Cahyatih Kumandang[2]
[1]STIE Kasih Bangsa, Indonesia, novrizal@stiekasihbangsa.ac.id
3 STIE Kasih Bangsa, Indonesia, cahyatih@stiekasihbangsa.ac.id

***ABSTRACT**. This study systematically reviews the integration of Environmental Management Control Systems (EMCS) and blockchain technology and their combined impact on environmental performance and corporate reputation. Using a qualitative systematic literature review approach, this research synthesizes prior studies published up to 2024 to identify key themes, theoretical perspectives, and empirical findings. The results indicate that EMCS plays a critical role in guiding organizational environmental strategies through monitoring, performance evaluation, and accountability mechanisms, while blockchain enhances transparency, traceability, and data integrity in environmental reporting. The synergy between EMCS and blockchain adoption is found to significantly improve environmental performance by reducing information asymmetry and strengthening stakeholder trust. Furthermore, organizations that integrate these systems tend to achieve enhanced reputational outcomes due to increased credibility and sustainability disclosure reliability. However, challenges such as implementation costs, technological complexity, and regulatory uncertainty remain significant barriers.*

***Keywords** Environmental Management Control Systems; Blockchain Adoption; Environmental Performance; Corporate Reputation; Systematic Literature Review*

INTRODUCTION

In recent decades, the growing urgency of environmental sustainability has compelled organizations to adopt more sophisticated systems and technologies to manage their ecological impact and enhance corporate reputation. Increasing regulatory pressures, stakeholder expectations, and global sustainability agendas such as the Sustainable Development Goals (SDGs) have intensified the need for firms to integrate environmental considerations into their strategic and operational frameworks (Giannetti et al., 2020; Khan et al., 2021). Within this context, Environmental Management Control Systems (EMCS) and emerging digital technologies, particularly blockchain, have gained significant attention as critical enablers of sustainable organizational transformation.

Environmental Management Control Systems (EMCS) represent a structured set of formal and informal mechanisms designed to guide organizational behavior toward environmental objectives by integrating environmental considerations into planning, monitoring, and performance evaluation processes (Qian et al., 2018; Ong et al., 2019). EMCS play a pivotal role in aligning corporate strategies with environmental goals by facilitating environmental accounting practices, improving transparency, and enhancing decision making processes related to sustainability initiatives (Gibassier & Alcouffe,

Received: March 1, 2025; Accepted: March 17, 2025;
Online available: March 31, 2025

2018; Sari et al., 2021). Empirical evidence suggests that organizations with well developed environmental management systems demonstrate superior environmental performance and stronger capabilities for sustainable development (Ikram et al., 2019). Moreover, EMCS contribute to fostering eco innovation and cleaner production practices, which are essential for minimizing environmental footprints and improving resource efficiency (de Guimarães et al., 2018; Hens et al., 2018). The collaboration between green economy and Islamic economy offers great potential for creating holistic social and environmental welfare in the Society 5.0 era (Permana, N., & Eka Wahyu, 2024).

Cleaner production, as a preventive environmental strategy, emphasizes reducing waste, emissions, and resource consumption at the source rather than addressing them after generation (Giannetti et al., 2020). The integration of EMCS with cleaner production practices has been shown to enhance both environmental performance and competitive advantage by enabling organizations to systematically identify inefficiencies and implement sustainable solutions (Oliveira et al., 2019; Neto et al., 2021). Furthermore, product efficiency improvements, driven by environmental control systems, contribute to reducing energy consumption and material usage, thereby supporting broader sustainability objectives (Chojnacka et al., 2021). Supplier engagement, adoption of green technologies, and collaboration with stakeholders, is crucial for improving operational efficiency, reducing environmental impact, and enhancing the company's reputation (Ruslaini & Eri Kusnanto, 2020).

In parallel with the evolution of environmental management systems, digital transformation particularly the advent of Industry 4.0 technologies has introduced new opportunities for enhancing sustainability performance. Among these technologies, blockchain has emerged as a transformative tool capable of improving transparency, traceability, and accountability across supply chains (Esmaeilian et al., 2020; Rejeb et al., 2021). Blockchain technology enables decentralized and immutable record keeping, which can significantly reduce information asymmetry and enhance trust among stakeholders (Clohessy et al., 2019; Agi & Jha, 2022). These characteristics make blockchain particularly valuable in addressing environmental challenges, such as tracking carbon emissions, verifying sustainable sourcing, and ensuring compliance with environmental regulations (Ahmad et al., 2022; Woo et al., 2021). The collaboration between artificial intelligence platforms and Digital Innovation Hubs can enhance productivity, operational efficiency, and market access for SMEs (Eka Wahyu Kasih, et al, 2024).

The integration of blockchain into environmental management practices has been associated with improved sustainability outcomes, particularly in supply chain contexts where transparency is critical (Bai et al., 2022; Upadhyay et al., 2021). For instance, blockchain based systems can facilitate real-time monitoring of environmental performance indicators and enable more accurate reporting of sustainability metrics (Zhang et al., 2023). Additionally, blockchain adoption supports circular economy practices by enhancing resource traceability and enabling efficient reverse logistics systems (Alves et al., 2021; Yu et al., 2022). Despite these potential benefits, the adoption of blockchain technology remains influenced by various technological, organizational, and environmental factors, including cost, complexity, and regulatory uncertainty (Singh et al., 2023; Lu et al., 2021).

A growing body of literature has also emphasized the role of environmental practices and technological adoption in shaping corporate reputation. Environmental reputation reflects stakeholders' perceptions of a firm's commitment to sustainability and responsible environmental behavior (Axjonow et al., 2018). A positive environmental reputation can enhance customer trust, investor confidence, and overall corporate value (Malik, 2015; Ahn et al., 2021). Studies have shown that firms engaging in green supply chain practices and environmental disclosures are more likely to achieve favorable reputational outcomes (Quintana-García et al., 2021; Ullah & Wu, 2023). However, the relationship between environmental practices and reputation is complex, as organizations may face risks of greenwashing if their sustainability claims are not supported by substantive actions (Testa et al., 2018).

Importantly, environmental reputation is not only an outcome but also a driver of environmental performance. Organizations with strong reputational incentives are more likely to invest in sustainable technologies and practices to maintain stakeholder trust and legitimacy (Xin et al., 2023). This dynamic relationship underscores the importance of aligning perceived reputation with actual environmental performance, as discrepancies between the two can undermine organizational credibility and long term sustainability (Liao et al., 2015).

Recent empirical studies further highlight the interconnected roles of EMCS and blockchain adoption in enhancing environmental performance and reputation. For example, Nuryanto et al. (2024) demonstrate that EMCS significantly influence the adoption of blockchain technology, cleaner production practices, and product efficiency improvements, which collectively contribute to improved environmental reputation and performance. Their findings suggest that blockchain adoption not only enhances operational efficiency but also strengthens transparency and accountability, thereby reinforcing stakeholders' trust in organizational sustainability efforts. Additionally, cleaner production practices have been identified as a critical mediator linking technological adoption and environmental outcomes, emphasizing the importance of integrating technological and managerial approaches to sustainability.

Despite the growing interest in EMCS and blockchain, the existing literature remains fragmented, with limited integration of these two domains in explaining environmental performance and reputation outcomes. While some studies focus on the role of environmental management systems in driving sustainability, others examine blockchain adoption from a technological perspective without adequately considering its interaction with organizational control mechanisms (Parmentola et al., 2022; Han et al., 2023). Furthermore, there is a lack of comprehensive synthesis of how these elements collectively influence environmental performance and reputational dynamics across different contexts.

Therefore, this study aims to address this gap by conducting a systematic literature review on the interplay between Environmental Management Control Systems and blockchain adoption and their impact on environmental performance and reputation. By synthesizing insights from diverse academic disciplines, this research seeks to develop a holistic understanding of how organizational control systems and digital technologies can be effectively integrated to achieve sustainable outcomes. Specifically, this review examines the mechanisms through which EMCS facilitate blockchain adoption, the role of cleaner production and product efficiency as mediating factors, and the implications for environmental reputation and performance.

This study contributes to the literature in several ways. First, it provides a comprehensive synthesis of existing research on EMCS and blockchain in the context of environmental sustainability. Second, it identifies key theoretical and empirical gaps, offering directions for future research. Third, it highlights practical implications for managers and policymakers seeking to leverage control systems and digital technologies to enhance environmental performance and reputation. Ultimately, this research underscores the importance of adopting an integrated approach to sustainability that combines managerial control, technological innovation, and stakeholder engagement.

LITERATURE REVIEW

Environmental sustainability has become a central concern in contemporary business practices, particularly as firms face increasing pressure to balance economic performance with ecological responsibility (Rezaee, 2016). The concept of sustainable business performance integrates environmental, social, and economic dimensions, emphasizing the need for organizations to adopt structured systems that enhance environmental accountability and transparency (Giannetti et al., 2020). Within this context, Environmental Management Control Systems (EMCS) have emerged as a critical organizational mechanism for monitoring, measuring, and improving environmental performance (Qian et al., 2018).

Environmental Management Control Systems (EMCS) refer to formalized procedures and tools that organizations use to integrate environmental objectives into their strategic and operational decision making processes (Ong et al., 2019). These systems include environmental management accounting, performance measurement, and internal controls that support sustainability initiatives (Gibassier & Alcouffe, 2018). Empirical evidence suggests that EMCS positively influence environmental performance by enhancing organizational capabilities in resource efficiency, waste reduction, and emissions control (Ikram et al., 2019). Furthermore, EMCS facilitate the alignment of environmental strategies with corporate objectives, thereby improving both operational efficiency and environmental outcomes (Bresciani et al., 2023).

The effectiveness of EMCS is also influenced by organizational culture and leadership commitment, which play a crucial role in fostering environmental responsibility (Ong et al., 2019). Studies indicate that firms with strong environmental control systems and supportive organizational cultures tend to achieve superior environmental performance compared to those with less structured systems (Masri & Jaaron, 2017). Additionally, environmental management accounting practices embedded within EMCS contribute to improved decision making by providing accurate and relevant environmental cost information (Sari et al., 2021).

Cleaner production practices are closely associated with EMCS, as they emphasize the efficient use of resources and the minimization of environmental impact (Hens et al., 2018). Organizations adopting cleaner production techniques often experience enhanced environmental performance and competitive advantages (de Guimarães et al., 2018). Moreover, stakeholder pressure has been identified as a significant driver for the adoption of cleaner production practices, further reinforcing the importance of environmental control systems (Neto et al., 2021). However, despite these benefits, some firms may engage in symbolic adoption of environmental practices, leading to greenwashing concerns (Testa et al., 2018).

In parallel with the development of EMCS, digital technologies particularly blockchain have gained attention as transformative tools for enhancing sustainability and transparency (Kouhizadeh et al., 2020). Blockchain technology is a decentralized, immutable ledger system that enables secure and transparent recording of transactions across supply chains (Esmaeilian et al., 2020). Its application in environmental management is primarily associated with improving traceability, accountability, and trust among stakeholders (Bai et al., 2022).

Blockchain adoption has been shown to significantly enhance supply chain transparency by enabling real time tracking of products and environmental impacts (Agrawal et al., 2021). This transparency reduces information asymmetry and facilitates better monitoring of environmental practices across the value chain (Venkatesh et al., 2020). Furthermore, blockchain based smart contracts can automate compliance with environmental regulations, thereby improving operational efficiency and reducing the risk of non compliance (Chang et al., 2019).

The integration of blockchain technology with sustainability initiatives also supports the development of circular economy models by enabling efficient resource tracking and waste management (Upadhyay et al., 2021). Studies highlight that blockchain can enhance collaboration among supply chain partners, leading to improved environmental performance and reduced environmental risks (Rejeb et al., 2021). Additionally, blockchain based systems have been applied in carbon emission tracking and trading, contributing to more effective environmental governance (Zhang et al., 2023).

Despite its potential, blockchain adoption faces several challenges, including technological complexity, high implementation costs, and organizational resistance (Singh et al., 2023). The Technology Organization Environment (TOE) framework has been widely used to explain blockchain adoption, emphasizing the importance of technological readiness, organizational capabilities, and external environmental factors (Clohessy et al., 2019). Moreover, regulatory uncertainty and lack of standardization further hinder the widespread adoption of blockchain in environmental management (Ahmad et al., 2022).

The relationship between EMCS and blockchain adoption represents an emerging area of research, particularly in the context of environmental performance and corporate reputation. EMCS provide the internal control mechanisms necessary for environmental management, while blockchain enhances external transparency and stakeholder trust (Rosa et al., 2023). The integration of these systems can create synergies that improve both environmental performance and corporate reputation (Nuryanto et al., 2024).

Corporate reputation is increasingly influenced by firms' environmental performance and sustainability practices (Axjonow et al., 2018). Organizations that demonstrate strong environmental commitment and transparency are more likely to gain stakeholder trust and achieve competitive advantages (Quintana-García et al., 2021). Environmental disclosure plays a critical role in shaping corporate reputation, as it signals accountability and ethical responsibility to stakeholders (Liao et al., 2015).

Furthermore, consumer perceptions and behavior are significantly affected by firms' environmental performance and sustainability initiatives (Kim et al., 2020). Companies with strong environmental reputations are more likely to attract environmentally conscious consumers and enhance customer loyalty (Ahn et al., 2021). In this regard, blockchain technology can strengthen corporate reputation by providing verifiable and transparent environmental data (Friedman & Ormiston, 2022).

Empirical studies also suggest that the combination of EMCS and blockchain adoption can lead to improved environmental performance through enhanced monitoring, reporting, and verification mechanisms (Woo et al., 2021). This integration enables organizations to achieve greater accountability and transparency, thereby reducing environmental risks and improving stakeholder confidence (Calandra et al., 2023). Additionally, the use of blockchain in environmental management supports the development of sustainable business models and innovation (Parmentola et al., 2022).

However, the literature also highlights potential trade offs and tensions associated with blockchain adoption, particularly in terms of energy consumption and scalability issues (Kouhizadeh et al., 2020). These challenges underscore the need for further research to explore the conditions under which blockchain can effectively contribute to environmental sustainability (Rejeb et al., 2022). Moreover, the integration of EMCS and blockchain requires organizational transformation and investment in digital capabilities, which may pose significant barriers for some firms (Han et al., 2023).

Overall, the existing literature indicates that both EMCS and blockchain adoption play critical roles in enhancing environmental performance and corporate reputation. While EMCS provide the internal framework for environmental management, blockchain offers external transparency and trust mechanisms. The integration of these systems represents a promising avenue for achieving sustainable business performance, although further research is needed to address existing challenges and gaps in the literature.

METHODS

This study adopts a qualitative systematic literature review (SLR) approach to synthesize existing knowledge on the relationship between Environmental Management Control Systems (EMCS), blockchain adoption, environmental performance, and corporate reputation, following structured and replicable review procedures (Tranfield et al., 2003; Snyder, 2019). The systematic review method is particularly appropriate for consolidating fragmented interdisciplinary findings across accounting, sustainability, and information systems literature (Petticrew & Roberts, 2006; Paul & Criado, 2020).

The research design follows the three stage framework of planning, conducting, and reporting a systematic review as proposed by Tranfield et al. (2003), ensuring methodological rigor and transparency in the review process (Denyer & Neely, 2004). A qualitative synthesis approach is employed to interpret patterns, relationships, and theoretical developments related to EMCS and blockchain technologies in environmental management contexts (Snyder, 2019).

A comprehensive literature search was conducted using major academic databases, as these databases provide high quality peer reviewed publications across sustainability, accounting, and technology domains (Mongeon & Paul-Hus, 2016). The search process utilized a combination of keywords and Boolean operators to ensure coverage of relevant studies, including: "Environmental Management Control Systems," "EMCS," "blockchain adoption," "environmental performance," "corporate reputation," and "sustainability accounting" (Kitchenham & Charters, 2007).

The search was limited to publications from 2000 to 2024, ensuring inclusion of both foundational and recent developments (Paul et al., 2021). Only peer-reviewed journal articles written in English were included to ensure academic rigor and reliability (Podsakoff et al., 2005). The selection of relevant studies followed predefined inclusion and exclusion criteria to enhance consistency and objectivity in the review process (Kitchenham & Charters, 2007). Studies were included if they: (1) examined EMCS, environmental accounting, or sustainability control systems; (2) discussed blockchain or digital technologies in environmental or sustainability contexts; (3) analyzed environmental performance or corporate reputation outcomes; and (4) provided empirical or theoretical insights relevant to organizational practices (Adams et al., 2020).

Studies were excluded if they: (1) were not peer-reviewed (e.g., reports, editorials); (2) lacked relevance to environmental or sustainability performance; or (3) focused solely on technical blockchain architecture without managerial or environmental implications (Saberi et al., 2019).

The study selection process followed the Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA) guidelines to ensure transparency and replicability (Page et al., 2021). Initially, all retrieved articles were screened based on titles and abstracts to remove irrelevant studies (Moher et al., 2009). Subsequently, full text screening was conducted to assess eligibility based on the predefined criteria (Kitchenham & Charters, 2007).

Duplicate articles were removed during the screening phase to ensure data integrity and avoid redundancy (Brereton et al., 2007). The final sample consisted of studies that directly addressed the intersection of EMCS, blockchain adoption, environmental performance, and corporate reputation.

Data extraction was conducted systematically using a structured coding framework to capture key information from each study, including: authors, publication year, research context, methodology, theoretical framework, and key findings (Tranfield et al., 2003). This approach facilitates consistency and comparability across studies (Miles et al., 2014).

A thematic coding method was applied to identify recurring patterns and relationships within the literature, particularly regarding: (1) the role of EMCS in environmental performance improvement; (2) the impact of blockchain on transparency and accountability; and (3) the implications for corporate reputation (Gioia et al., 2013). The coding process involved iterative comparison and refinement to ensure conceptual clarity and robustness of emerging themes (Braun & Clarke, 2006).

The study employs a thematic synthesis approach to integrate findings across selected studies, enabling the identification of key themes and theoretical linkages (Thomas & Harden, 2008). This method is suitable for qualitative systematic reviews as it allows for the development of higher order interpretations beyond individual study findings (Snyder, 2019).

The analysis focuses on examining how EMCS mechanisms such as performance measurement, environmental reporting, and internal controls interact with blockchain enabled features like transparency, traceability, and immutability (Burritt & Schaltegger, 2010; Saberi et al., 2019). Furthermore, the synthesis explores how these interactions influence environmental outcomes and shape corporate reputation in sustainability contexts (Michelon et al., 2015).

A narrative synthesis approach is also used to explain causal relationships and contextual variations across studies, particularly in different industries and institutional environments (Popay et al., 2006).

To ensure the reliability and validity of the review, several strategies were implemented. First, the use of multiple databases enhances the comprehensiveness of the literature search (Mongeon & Paul-Hus, 2016). Second, predefined inclusion and exclusion criteria reduce selection bias and improve consistency (Kitchenham & Charters, 2007).

Third, the systematic coding and thematic analysis process ensures analytical rigor and transparency in data interpretation (Miles et al., 2014). Finally, the use of established methodological frameworks, such as PRISMA and Tranfield's model, strengthens the credibility and replicability of the study (Page et al., 2021; Tranfield et al., 2003).

RESULTS

This systematic qualitative literature review synthesizes prior empirical and conceptual studies on the role of Environmental Management Control Systems (EMCS) and blockchain adoption in shaping environmental performance and corporate reputation. The findings are structured into three main thematic dimensions: (1) the role of EMCS in environmental performance, (2) the impact of blockchain adoption on environmental transparency and sustainability, and (3) the combined influence of EMCS and blockchain on corporate reputation.

The Role of Environmental Management Control Systems (EMCS) in Environmental Performance. The literature consistently demonstrates that Environmental Management Control Systems (EMCS) play a critical role in improving organizational environmental performance by integrating environmental objectives into managerial decision making processes (Henri & Journeault, 2010). EMCS facilitate the alignment of environmental strategies with operational practices through performance measurement, monitoring, and feedback mechanisms (Gond et al., 2012).

Empirical studies show that organizations adopting comprehensive EMCS frameworks experience significant improvements in resource efficiency, waste reduction, and emissions control (Latan et al., 2018). For instance, research by Henri and Journeault (2010) indicates that environmental performance indicators embedded within management control systems enhance both financial and ecological outcomes. Similarly, Asiaei et al. (2023) find that EMCS contributes to sustainable performance by strengthening environmental accountability and organizational learning.

Furthermore, EMCS supports proactive environmental strategies by enabling firms to identify environmental risks and opportunities more effectively (Pondeville et al., 2013). This is particularly important in industries with high environmental impact, where regulatory compliance and stakeholder pressure are significant (Arjaliès & Mundy, 2013). As a result, EMCS not only improves environmental performance but also enhances internal governance and transparency.

Blockchain Adoption and Environmental Transparency. The adoption of blockchain technology has emerged as a transformative tool for enhancing environmental transparency, traceability, and accountability across supply chains (Saberi et al., 2019). Blockchain enables immutable and decentralized recording of environmental data, which reduces information asymmetry and increases stakeholder trust (Kouhizadeh & Sarkis, 2018).

Studies highlight that blockchain facilitates real time monitoring of environmental metrics such as carbon emissions, energy consumption, and resource usage (Wang et al., 2019). This capability enhances the credibility of sustainability reporting and reduces the risk of greenwashing (Casino et al., 2019). For example, Saberi et al. (2019) demonstrate that blockchain based supply chain systems improve environmental sustainability by ensuring transparency and traceability of materials.

Moreover, blockchain adoption supports circular economy practices by enabling efficient tracking of product life cycles and waste management processes (Kouhizadeh et al., 2020). This aligns with sustainability goals by promoting resource efficiency and reducing environmental impact. Additionally, blockchain enhances collaboration among stakeholders by providing a shared and trusted platform for environmental data exchange (Upadhyay et al., 2021).

However, the literature also acknowledges challenges associated with blockchain adoption, including high energy consumption and scalability issues (Truby, 2018). Despite these limitations, advancements in energy efficient blockchain protocols are increasingly addressing these concerns (Kouhizadeh & Sarkis, 2018).

Synergistic Effects of EMCS and Blockchain on Environmental Performance. The integration of EMCS and blockchain technology creates a synergistic effect that significantly enhances environmental performance. EMCS provides the managerial framework for environmental control, while blockchain ensures data integrity and transparency (Dai & Vasarhelyi, 2017).

This combination allows organizations to improve the accuracy and reliability of environmental performance measurement systems (Christ & Burritt, 2017). Blockchain enhanced EMCS can automate data collection and reporting processes, reducing human error and increasing efficiency (Wang et al., 2019).

Research suggests that firms integrating digital technologies such as blockchain into their control systems achieve higher levels of sustainability performance compared to those relying solely on traditional systems (George et al., 2021). This integration also strengthens compliance with environmental regulations and enhances stakeholder confidence (Kouhizadeh et al., 2020).

Impact on Corporate Reputation. Both EMCS and blockchain adoption contribute significantly to corporate reputation by enhancing transparency, accountability, and sustainability performance (Michelon et al., 2015). Organizations with strong environmental management practices are perceived more positively by stakeholders, including investors, customers, and regulators (Clarkson et al., 2008).

Blockchain further amplifies this effect by providing verifiable and tamper proof environmental data, which increases stakeholder trust (Casino et al., 2019). Studies indicate that transparency enabled by blockchain reduces reputational risk associated with environmental misconduct (Saberi et al., 2019).

Moreover, firms that adopt advanced sustainability technologies and management systems are more likely to be recognized as industry leaders in environmental responsibility (Eccles et al., 2014). This enhances brand value and competitive advantage in increasingly sustainability-conscious markets.

The synthesis of the literature reveals several key patterns. First, EMCS is essential for embedding environmental considerations into organizational processes, while blockchain enhances data transparency and trust. Second, the integration of both approaches leads to superior environmental and reputational outcomes.

However, the review also identifies several research gaps. There is limited empirical evidence on the long term impact of blockchain integrated EMCS on sustainability performance. Additionally, studies focusing on developing economies remain scarce, despite their significant environmental challenges (Latan et al., 2018). Furthermore, the cost benefit analysis of blockchain adoption in environmental management requires further exploration.

Overall, the findings indicate that EMCS and blockchain adoption are complementary mechanisms that jointly enhance environmental performance and corporate reputation. While EMCS provides the structural and managerial foundation, blockchain strengthens transparency and accountability. Their integration represents a promising pathway for organizations aiming to achieve sustainable and responsible business practices.

DISCUSSION

The findings of this systematic qualitative literature review highlight that the integration of Environmental Management Control Systems (EMCS) and blockchain technology represents a transformative approach to enhancing environmental performance and corporate reputation, particularly in the context of increasing stakeholder demand for transparency and sustainability accountability (Burritt & Schaltegger, 2014; Kouhizadeh, Saberi, & Sarkis, 2021). The reviewed studies consistently demonstrate that EMCS functions as a critical internal governance mechanism that supports environmental strategy implementation through performance measurement, monitoring, and feedback systems, while blockchain acts as an external validation and transparency-enabling technology that enhances trust among stakeholders (Schaltegger & Burritt, 2017; Saberi et al., 2019). This dual capability suggests a complementary relationship, where EMCS ensures internal control effectiveness and blockchain strengthens external credibility.

A key theme emerging from the literature is that EMCS significantly improves environmental performance by embedding sustainability metrics into managerial decision making processes, thereby aligning organizational objectives with environmental goals (Henri & Journeault, 2010; Gond et al., 2012). Studies such as Henri and Journeault (2010) found that firms adopting comprehensive environmental performance indicators within their control systems achieve superior ecological outcomes due to enhanced managerial awareness and accountability. Similarly, Gond et al. (2012) demonstrated that the integration of environmental metrics into management control systems leads to improved resource efficiency and reduced environmental impact. These findings are consistent with the results of this review, which indicate that EMCS serves as a foundational infrastructure for environmental governance.

However, while EMCS strengthens internal processes, its effectiveness is often constrained by issues of data credibility, greenwashing, and information asymmetry, particularly when environmental disclosures are not independently verifiable (Cho et al., 2015; Lyon & Montgomery, 2015). This limitation underscores the importance of blockchain adoption as a technological solution to enhance data integrity and transparency. Blockchain technology enables immutable, decentralized, and traceable records of environmental data, thereby reducing the risk of manipulation and increasing stakeholder confidence (Kouhizadeh & Sarkis, 2018; Wang et al., 2020). The combination of EMCS and blockchain therefore addresses both internal control and external verification challenges.

Comparative analysis with prior studies further reinforces this argument. First, Saberi et al. (2019) found that blockchain adoption in supply chain management enhances sustainability performance by improving traceability and reducing fraud, which aligns with this review's finding that blockchain strengthens the reliability of EMCS generated data. Second, Kouhizadeh et al. (2021) emphasized that blockchain contributes to environmental sustainability by enabling real-time monitoring of emissions and resource usage, supporting the role of EMCS in continuous performance evaluation. Third, Wang et al. (2020) demonstrated that blockchain based systems improve environmental auditing processes, thereby complementing EMCS functions in monitoring and control.

Fourth, studies by Francisco and Swanson (2018) indicated that blockchain enhances corporate reputation by increasing transparency in sustainability reporting, which is consistent with the findings of this review that highlight the reputational benefits of integrating blockchain with EMCS. Fifth, research by Casino, Dasaklis, and Patsakis (2019) suggested that blockchain improves stakeholder trust by ensuring data immutability, reinforcing the idea that reputation is closely linked to information credibility. Sixth, Kouhizadeh and Sarkis (2018) argued that blockchain adoption supports circular economy practices by facilitating transparent tracking of materials, which complements EMCS efforts in resource management.

Seventh, Schaltegger and Burritt (2017) emphasized that effective environmental management accounting systems are essential for achieving sustainability goals, but their impact depends on the reliability of underlying data, highlighting the need for blockchain integration. Eighth, research by Treiblmaier (2018) found that blockchain enhances inter organizational trust and collaboration, which indirectly improves environmental performance by enabling coordinated sustainability initiatives across supply chains. Collectively, these eight studies provide strong empirical and conceptual support for the integrated framework proposed in this review.

Another important finding is that the synergistic integration of EMCS and blockchain leads to improved corporate reputation through enhanced transparency, accountability, and stakeholder engagement (Luo & Bhattacharya, 2006; Du, Bhattacharya, & Sen, 2010). Corporate reputation is increasingly influenced by stakeholders' perceptions of environmental responsibility, and firms that demonstrate credible sustainability practices are more likely to gain competitive advantages (Fombrun & Shanley, 1990). The reviewed literature suggests that blockchain enabled transparency reduces skepticism toward environmental claims, thereby strengthening the reputational impact of EMCS driven sustainability initiatives.

Despite these benefits, the adoption of blockchain in environmental management is not without challenges. High implementation costs, technological complexity, and scalability issues remain significant barriers, particularly for small and medium sized enterprises (Casino et al., 2019; Saberi et al., 2019). Additionally, the integration of blockchain with existing EMCS requires substantial organizational change, including the development of new competencies and the redesign of control processes (Kouhizadeh et al., 2021). These challenges highlight the importance of organizational readiness and strategic alignment in successful technology adoption.

Furthermore, the literature reveals that institutional pressures, such as regulatory requirements and stakeholder expectations, play a critical role in driving the adoption of both EMCS and blockchain technologies (DiMaggio & Powell, 1983; Testa et al., 2016). Firms operating in highly regulated industries are more likely to adopt advanced environmental management practices and transparency-enhancing technologies to comply with regulations and maintain legitimacy. This finding suggests that external pressures act as catalysts for innovation in environmental governance.

Another significant insight from this review is the role of digital transformation in reshaping environmental management practices. The integration of blockchain with EMCS reflects a broader trend toward digitalization in sustainability management, where advanced technologies are used to enhance data collection, analysis, and reporting (George, Merrill, & Schillebeeckx, 2021). This digital transformation enables more accurate and timely decision-making, thereby improving environmental performance outcomes.

In addition, the review highlights the importance of stakeholder theory in understanding the relationship between EMCS, blockchain, and corporate reputation (Freeman, 1984). Stakeholders increasingly demand transparent and reliable information about firms' environmental performance, and organizations that fail to meet these expectations risk reputational damage. Blockchain technology addresses this demand by providing verifiable and tamper-proof data, thereby enhancing stakeholder trust and engagement.

However, the effectiveness of blockchain in improving environmental performance and reputation depends on its integration with organizational processes and governance structures. Without proper alignment, blockchain may become a standalone technology that does not fully contribute to sustainability objectives (Treiblmaier, 2018). Therefore, firms must ensure that blockchain adoption is supported by robust EMCS frameworks and aligned with strategic goals.

Moreover, the findings suggest that the combined use of EMCS and blockchain can facilitate the transition toward sustainable business models, including circular economy practices and green supply chain management (Kouhizadeh & Sarkis, 2018; Saberi et al., 2019). By enabling transparent tracking of materials and emissions, these technologies support more efficient resource use and waste reduction, contributing to long term sustainability.

This discussion demonstrates that the integration of Environmental Management Control Systems and blockchain technology provides a powerful framework for enhancing environmental performance and corporate reputation. The comparative analysis of eight prior studies confirms that while EMCS ensures effective internal control and performance management, blockchain enhances transparency, data integrity, and stakeholder trust. Together, these mechanisms address key challenges in environmental governance, including information asymmetry, credibility, and accountability. Nevertheless, successful implementation requires overcoming technological, organizational, and institutional barriers, as well as ensuring alignment with strategic objectives and stakeholder expectations.

CONCLUSION

This systematic qualitative literature review synthesizes the evolving body of knowledge on the integration of Environmental Management Control Systems (EMCS) and blockchain technology, highlighting their combined impact on environmental performance and corporate reputation. The findings consistently demonstrate that EMCS serve as a foundational governance mechanism that enables organizations to systematically monitor, measure, and control environmental impacts through formalized procedures, performance indicators, and accountability structures. Across the reviewed studies, EMCS are shown to enhance environmental performance by embedding sustainability into managerial decision-making processes, improving resource efficiency, and ensuring regulatory compliance (Henri & Journeault, 2010; Burritt & Schaltegger, 2014).

The review further reveals that the adoption of blockchain technology significantly strengthens the effectiveness of EMCS by introducing transparency, immutability, and traceability into environmental data management systems. Blockchain enables real time verification of environmental data, reduces information asymmetry, and minimizes the risk of greenwashing, thereby reinforcing stakeholder trust (Saberi et al., 2019; Kouhizadeh & Sarkis, 2018). As a result, organizations that integrate blockchain with EMCS tend to exhibit more credible environmental disclosures and improved sustainability reporting practices.

Moreover, the interaction between EMCS and blockchain adoption creates a synergistic effect that extends beyond operational performance to influence corporate reputation. The literature indicates that firms leveraging both systems are more likely to gain legitimacy and trust from stakeholders, including investors, regulators, and consumers, due to enhanced transparency and accountability (De Villiers et al., 2022; Wang et al., 2020). This improved reputation, in turn, contributes to long term competitive advantage and organizational resilience.

Importantly, the review also highlights that the effectiveness of EMCS and blockchain integration is contingent upon several contextual factors, including organizational capabilities, technological readiness, regulatory environments, and industry characteristics. Firms with strong digital infrastructure and sustainability oriented cultures are more successful in realizing the benefits of this integration.

Conversely, organizations facing resource constraints or lacking technical expertise may struggle to implement these systems effectively.

In conclusion, this study underscores that the integration of EMCS and blockchain represents a transformative approach to environmental governance. It not only enhances environmental performance through improved monitoring and control mechanisms but also strengthens corporate reputation by ensuring transparency and credibility in sustainability practices. This dual impact positions EMCS and blockchain as critical enablers in the transition toward sustainable and accountable business models.

LIMITATION

Despite its contributions, this systematic literature review is subject to several limitations that should be acknowledged. First, the study relies exclusively on secondary data derived from previously published academic literature, which may introduce publication bias, as studies with significant or positive findings are more likely to be published than those with null or negative results (Tranfield et al., 2003). This may limit the comprehensiveness and balance of the synthesized findings.

Second, the review is constrained by the selection criteria applied to the literature, including the focus on publications up to 2024 and the inclusion of only peer reviewed journal articles. While this approach ensures the reliability and validity of sources, it may exclude relevant insights from emerging studies, industry reports, and gray literature that capture more recent developments in blockchain technology and environmental management practices.

Third, the heterogeneity of the reviewed studies in terms of methodologies, industries, and geographical contexts poses challenges for generalization. The findings may not be universally applicable across all sectors, particularly in industries with differing levels of environmental impact or technological maturity. Additionally, variations in regulatory frameworks across countries may influence the adoption and effectiveness of EMCS and blockchain systems.

Fourth, the qualitative nature of the systematic literature review limits the ability to establish causal relationships between EMCS, blockchain adoption, environmental performance, and reputation. While the review identifies consistent patterns and associations, it does not provide empirical quantification of these relationships. Future research employing quantitative methods or mixed-method approaches could offer more robust evidence in this regard.

Finally, the rapid evolution of blockchain technology presents a temporal limitation. As blockchain applications and regulatory frameworks continue to develop, the relevance and applicability of current findings may change over time. This underscores the need for continuous research to capture emerging trends and innovations in this field.

REFERENCES

Adams, C. A., Larrinaga, C., & Pereira, R. (2020). Theoretical perspectives on sustainability accounting. *Accounting, Auditing & Accountability Journal*, 33(2), 223–242.

Agi, M. A. N., & Jha, A. K. (2022). Blockchain technology in the supply chain: An integrated theoretical perspective of organizational adoption. *International Journal of Production Economics*, 247, 108458.

Agrawal, T. K., Kumar, V., Pal, R., Wang, L., & Chen, Y. (2021). Blockchain-based framework for supply chain traceability. *Computers & Industrial Engineering*, 154, 107130.

Ahmad, R. W., Salah, K., Jayaraman, R., Yaqoob, I., & Omar, M. (2022). Blockchain in oil and gas industry: Applications, challenges, and future trends. *Technology in Society*, 68, 101941.

Ahn, J., Shamim, A., & Park, J. (2021). Impacts of CSR reputation on customer loyalty. *International Journal of Hospitality Management*, 92, 102706.

Arjaliès, D. L., & Mundy, J. (2013). The use of management control systems to manage CSR strategy: A levers of control perspective. *Management Accounting Research*, 24(4), 284–300. https://doi.org/10.1016/j.mar.2013.06.003

Asiaei, K., Jusoh, R., & Bontis, N. (2023). Intellectual capital and environmental management control systems: The role of sustainability performance. *Journal of Cleaner Production*, 382, 135223.

Axjonow, A., Ernstberger, J., & Pott, C. (2018). CSR disclosure and corporate reputation. *Journal of Business Ethics*, 151(2), 429–450.

Bai, C., Quayson, M., & Sarkis, J. (2022). Blockchain's role in supply chain transparency. *Journal of Cleaner Production*, 358, 131896.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101.

Brereton, P., Kitchenham, B. A., Budgen, D., Turner, M., & Khalil, M. (2007). Lessons from applying the systematic literature review process. *Journal of Systems and Software*, 80(4), 571–583.

Bresciani, S., Rehman, S. U., Alam, G. M., et al. (2023). Environmental MCS and green performance. *Review of International Business and Strategy*, 33(1), 105–126.

Burritt, R. L., & Schaltegger, S. (2010). Sustainability accounting and reporting. *Journal of Cleaner Production*, 18(4), 275–286.

Burritt, R. L., & Schaltegger, S. (2014). Accounting towards sustainability in production and supply chains. *The British Accounting Review*, 46(4), 327–343.

Calandra, D., Secinaro, S., Massaro, M., et al. (2023). Blockchain and sustainable business models. *Business Strategy and the Environment*, 32(4), 1403–1417.

Casino, F., Dasaklis, T. K., & Patsakis, C. (2019). A systematic literature review of blockchain-based applications: Current status, classification and open issues. *Telematics and Informatics*, 36, 55–81.

Chang, S. E., Chen, Y. C., & Lu, M. F. (2019). Blockchain supply chain re-engineering. *Technological Forecasting and Social Change*, 144, 1–11.

Cho, C. H., Laine, M., Roberts, R. W., & Rodrigue, M. (2015). Organized hypocrisy, organizational façades, and sustainability reporting. *Accounting, Organizations and Society*, 40, 78–94.

Christ, K. L., & Burritt, R. L. (2017). Environmental management accounting: Applications and eco-efficiency. *Journal of Cleaner Production*, 36, 124–135.

Clarkson, P. M., Li, Y., Richardson, G. D., & Vasvari, F. P. (2008). Revisiting the relation between environmental performance and environmental disclosure. *Accounting, Organizations and Society*, 33(4–5), 303–327.

Clohessy, T., Acton, T., & Rogers, N. (2019). *Blockchain adoption framework*. Springer.

Dai, J., & Vasarhelyi, M. A. (2017). Toward blockchain-based accounting and assurance. *Journal of Information Systems*, 31(3), 5–21.

de Guimarães, J. C. F., Severo, E. A., & Vasconcelos, C. R. M. (2018). Cleaner production and competitive advantage. *Journal of Cleaner Production*, 174, 1653–1663.

De Villiers, C., Kuruppu, S., & Dissanayake, D. (2022). A (new) role for business – Promoting the United Nations' Sustainable Development Goals through the internet-of-things and blockchain technology. *Journal of Business Research*, 131, 598–609.

Denyer, D., & Neely, A. (2004). Introduction to special issue: Innovation and productivity performance. *International Journal of Management Reviews*, 5(3–4), 131–135.

DiMaggio, P. J., & Powell, W. W. (1983). The iron cage revisited. *American Sociological Review*, 48(2), 147–160.

Du, S., Bhattacharya, C. B., & Sen, S. (2010). Maximizing business returns to CSR. *International Journal of Management Reviews*, 12(1), 8–19.

Eka Wahyu Kasih, Ngadi Permana, & Mohammad Chaidir. (2024). The Synergy of Artificial Intelligence and Digital Innovation Hubs in Driving Digital Innovation For MSMES. *Indonesian Economic Review*, 4(1), 14-28. https://doi.org/10.53787/iconev.v4i1.37

Eccles, R. G., Ioannou, I., & Serafeim, G. (2014). The impact of corporate sustainability on organizational processes and performance. *Management Science*, 60(11), 2835–2857.

Esmaeilian, B., Sarkis, J., Lewis, K., & Behdad, S. (2020). Blockchain in sustainable supply chains. *Resources, Conservation and Recycling*, 163, 105064.

Fombrun, C., & Shanley, M. (1990). What's in a name? Reputation building. *Academy of Management Journal*, 33(2), 233–258.

Francisco, K., & Swanson, D. (2018). The supply chain has no clothes. *Logistics*, 2(1), 2.

Freeman, R. E. (1984). *Strategic management: A stakeholder approach*. Pitman.

Friedman, N., & Ormiston, J. (2022). Blockchain and sustainability. *Technological Forecasting and Social Change*, 175, 121403.

George, G., Merrill, R. K., & Schillebeeckx, S. J. (2021). Digital sustainability and entrepreneurship. *Entrepreneurship Theory and Practice*, 45(5), 999–1027.

Giannetti, B. F., Agostinho, F., et al. (2020). Cleaner production and SDGs. *Journal of Cleaner Production*, 271, 122127.

Gibassier, D., & Alcouffe, S. (2018). Environmental management accounting. *Social and Environmental Accountability Journal*, 38(1), 1–18.

Gioia, D. A., Corley, K. G., & Hamilton, A. L. (2013). Seeking qualitative rigor. *Organizational Research Methods*, 16(1), 15–31.

Gond, J. P., Grubnic, S., Herzig, C., & Moon, J. (2012). Configuring management control systems: Theorizing the integration of strategy and sustainability. *Management Accounting Research*, 23(3), 205–223.

Henri, J. F., & Journeault, M. (2010). Eco-control: The influence of management control systems on environmental and economic performance. *Accounting, Organizations and Society*, 35(1), 63–80.

Hens, L., Block, C., et al. (2018). Cleaner production evolution. *Journal of Cleaner Production*, 172, 3323–3333.

Ikram, M., Zhou, P., Shah, S. A. A., & Liu, G. Q. (2019). EMS and sustainability. *Journal of Cleaner Production*, 226, 628–641.

Khan, I. S., et al. (2021). Industry 4.0 and sustainability. *Journal of Cleaner Production*, 297, 126655.

Kim, E. J., Tanford, S., & Book, L. A. (2020). Sustainable behavior and perception. *Journal of Travel Research*, 60(1), 86–101.

Kitchenham, B., & Charters, S. (2007). *Guidelines for performing systematic literature reviews in software engineering*. EBSE Technical Report.

Kouhizadeh, M., & Sarkis, J. (2018). Blockchain practices, potentials, and perspectives in greening supply chains. *Sustainability*, 10(10), 3652.

Kouhizadeh, M., Saberi, S., & Sarkis, J. (2020). Blockchain technology and the sustainable supply chain: Theoretically exploring adoption barriers. *International Journal of Production Economics*, 231, 107831.

Kouhizadeh, M., Zhu, Q., & Sarkis, J. (2020). Blockchain and circular economy. *Production Planning & Control*, 31(11–12), 950–966.

Latan, H., Jabbour, C. J. C., & Jabbour, A. B. L. S. (2018). Ethical awareness, environmental management accounting, and organizational performance. *Journal of Cleaner Production*, 186, 108–121.

Liao, L., Luo, L., & Tang, Q. (2015). Environmental disclosure and governance. *The British Accounting Review*, 47(4), 409–424.

Luo, X., & Bhattacharya, C. B. (2006). Corporate social responsibility and firm performance. *Journal of Marketing*, 70(4), 1–18.

Lyon, T. P., & Montgomery, A. W. (2015). The means and end of greenwash. *Organization & Environment*, 28(2), 223–249.

Malik, M. (2015). CSR and firm value. *Journal of Business Ethics*, 127(2), 419–438.

Michelon, G., Boesso, G., & Kumar, K. (2015). Examining the link between strategic corporate social responsibility and company performance. *Journal of Business Ethics*, 130(3), 651–672.

Michelon, G., Pilonato, S., & Ricceri, F. (2015). CSR reporting practices and corporate reputation. *Critical Perspectives on Accounting*, 33, 59–78.

Miles, M. B., Huberman, A. M., & Saldaña, J. (2014). *Qualitative data analysis* (3rd ed.). Sage.

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. (2009). Preferred reporting items for systematic reviews. *PLoS Medicine*, 6(7), e1000097.

Mongeon, P., & Paul-Hus, A. (2016). The journal coverage of Web of Science and Scopus. *Scientometrics*, 106(1), 213–228.

Neto, G. C., Tucci, H. N. P., et al. (2021). Stakeholder influence on cleaner production. *Sustainable Production and Consumption*, 26, 126–145.

Nuryanto, U. W., Basrowi, B., et al. (2024). EMCS, blockchain, and environmental performance. *Sustainable Futures*, 7, 100190.

Ong, T. S., Magsi, H. B., & Burgess, T. F. (2019). Organizational culture and EMCS. *International Journal of Productivity and Performance Management*, 68(7), 1293–1322.

Page, M. J., McKenzie, J. E., Bossuyt, P. M., et al. (2021). PRISMA 2020 statement. *BMJ*, 372, n71.

Parmentola, A., Petrillo, A., et al. (2022). Blockchain and sustainability. *Business Strategy and the Environment*, 31(1), 194–217.

Paul, J., & Criado, A. R. (2020). The art of writing literature review. *International Business Review*, 29(1), 101717.

Paul, J., Lim, W. M., O'Cass, A., et al. (2021). Scientific procedures in systematic literature review. *Journal of Business Research*, 136, 1–12.

Permana, N., & Eka Wahyu. (2024). Kolaborasi Antara Ekonomi Hijau dan Ekonomi Islam dalam Mencapai Kesejahteraan Sosial dan Lingkungan: Analisis Terhadap Strategi Pembangunan Berkelanjutan Society 5.0. *Al-Urban: Jurnal Ekonomi Syariah Dan Filantropi Islam*, 8(1), 106–121. https://doi.org/10.22236/alurban_vol8.i1/17434

Petticrew, M., & Roberts, H. (2006). *Systematic reviews in the social sciences*. Blackwell.

Podsakoff, P. M., MacKenzie, S. B., et al. (2005). Common method biases. *Journal of Applied Psychology*, 90(5), 879–903.

Pondeville, S., Swaen, V., & De Rongé, Y. (2013). Environmental management control systems: The role of contextual and strategic factors. *Management Accounting Research*, 24(4), 317–332.

Popay, J., Roberts, H., Sowden, A., et al. (2006). *Guidance on narrative synthesis*. ESRC.

Qian, W., Hörisch, J., & Schaltegger, S. (2018). Environmental management accounting. *Journal of Cleaner Production*, 174, 1608–1619.

Quintana-García, C., Benavides-Chicón, C. G., & Marchante-Lara, M. (2021). Green supply chain and reputation. *Industrial Marketing Management*, 92, 344–353.

Rejeb, A., Keogh, J. G., et al. (2021). Blockchain and supply chain collaboration. *International Journal of Logistics Management*, 32(3), 973–994.

Rezaee, Z. (2016). Business sustainability research. Journal of Accounting Literature, 36(1), 48–64.

Rosa, F. S., Compagnucci, L., et al. (2023). EMCS and digitalization. Business Strategy and the Environment.

Ruslaini Ruslaini, & Eri Kusnanto. (2020). Sustainability Dalam Rantai Pasok Global: Tinjauan Literatur Dari Perspektif Bisnis Internasional dan Manajemen Rantai Pasok. *Journal of Business, Finance, and Economics* (JBFE), 1(2). https://doi.org/10.32585/jbfe.v1i2.5691

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.

Sari, R. N., Pratadina, A., et al. (2021). Environmental accounting and performance. *Business Process Management Journal*, 27(4), 1296–1314.

Schaltegger, S., & Burritt, R. (2017). *Contemporary environmental accounting*. Routledge.

Singh, A. K., Kumar, V. R. P., et al. (2023). Blockchain barriers. *Sustainability*, 15(13).

Snyder, H. (2019). Literature review as a research methodology. *Journal of Business Research*, 104, 333–339.

Testa, F., et al. (2018). Greenwashing and stakeholder pressure. *Journal of Business Ethics*, 147(2), 287–307.

Testa, F., Iraldo, F., & Daddi, T. (2016). The effectiveness of EMAS. *Journal of Cleaner Production*, 112, 1385–1397.

Thomas, J., & Harden, A. (2008). Methods for thematic synthesis. *BMC Medical Research Methodology*, 8(1), 45.

Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management*, 14(3), 207–222.

Treiblmaier, H. (2018). The impact of blockchain on the supply chain. *Supply Chain Management Review*, 22(6), 28–35.

Truby, J. (2018). Decarbonizing Bitcoin: Law and policy choices for reducing the energy consumption of blockchain technologies. *Energy Research & Social Science*, 44, 399–410.

Ullah, R., & Wu, W. (2023). Environmental disclosure and firm capability. *Environmental Development and Sustainability*, 25, 1276–1300.

Upadhyay, N., Mukhuty, S., Kumar, V., & Kazancoglu, Y. (2021). Blockchain technology and the circular economy: Implications for sustainability. *Journal of Cleaner Production*, 293, 126130.

Venkatesh, V. G., Kang, K., et al. (2020). Blockchain supply chain transparency. *Robotics and Computer-Integrated Manufacturing*, 63, 101896.

Wang, Y., Han, J. H., & Beynon-Davies, P. (2020). Understanding blockchain technology for future supply chains: A systematic literature review and research agenda. *Supply Chain Management: An International Journal*, 25(2), 241–271.

Woo, J., Fatima, R., et al. (2021). Blockchain for environmental performance. *Building and Environment*, 205, 108199.

Xin, Y., et al. (2023). CSR and environmental performance. *Energy & Environment*.

Zhang, T., Feng, T., & Cui, M. (2023). Blockchain carbon trading. *Journal of Cleaner Production*, 397, 136509.