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Digital Transformation Strategies Driving Circular Economy Practices Among Small Enterprises

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Abstract:
Digital transformation has become a strategic necessity for enabling small enterprises to implement circular economy practices while improving sustainable business performance. This study examines how digital transformation strategies drive circular economy implementation among small enterprises. A qualitative multiple-case study was employed involving 24 purposively selected informants comprising enterprise owners, digital consultants, government officers, business association representatives, and sustainability experts, with data collected through interviews, observations, and document analysis and analyzed using the Miles, Huberman, and Saldaña interactive model. The findings reveal that digital capability improves resource management efficiency through systematic digital monitoring, data-driven innovation strengthens sustainable managerial decision-making, and collaborative digital ecosystems accelerate circular economy adoption through marketplace-based business integration. This study proposes an integrated qualitative framework linking digital capability, managerial analytics, and collaborative ecosystems. The findings provide strategic guidance for policymakers and enterprise managers in strengthening digitally enabled circular economy implementation.

INTRODUCTION

Digital transformation has become a fundamental force reshaping how small enterprises operate, innovate, and create economic value amid increasing demands for sustainable development. Rather than merely representing the adoption of advanced technologies, digital transformation has evolved into a strategic capability that enables resource optimization, operational efficiency, and waste reduction through circular economy practices (Cifone et al., 2021; Jovkovska, 2023; Meshalkin et al., 2021). This issue is particularly significant because small enterprises constitute the backbone of many national economies while simultaneously contributing considerably to resource consumption and environmental pressures. Consequently, integrating digital transformation with circular economy principles has become a strategic priority for achieving sustainable economic, social, and environmental development (Jeswani et al., 2021; Kazancoglu et al., 2023; Lakshmi et al., 2024). Society increasingly requires business models that generate long-term economic growth while minimizing

resource depletion and environmental degradation, thereby supporting inclusive and sustainable development across industries.

Despite the growing importance of digital transformation, implementing circular economy practices among small enterprises continues to face substantial challenges. Many businesses still rely on the traditional linear economic model characterized by extracting resources, producing goods, consuming products, and disposing of waste without considering resource recovery or regeneration (Arestis et al., 2023; Liwei, 2021). Limited digital literacy, inadequate technological investment, fragmented operational data, and weak collaboration across supply chains exacerbate this condition. As a result, resource utilization remains inefficient, production waste continues to increase, and opportunities for material recovery and product life extension are frequently overlooked (Alvarado et al., 2021; Barbieri et al., 2021). These realities indicate that digitalization alone does not automatically lead to circular economy implementation unless supported by comprehensive transformation strategies that integrate technological innovation, organizational capabilities, and sustainability-oriented business processes.

Previous studies have extensively examined digital transformation and sustainable business development; however, these two concepts have generally been investigated independently rather than as mutually reinforcing strategic mechanisms. Zhou et al. (2021) and Fernández et al. (2021) argued that digital technologies enhance organizational performance by improving business process integration and operational efficiency. Pavlenko et al. (2023), Krishna et al. (2024), and Rababah et al. (2024) emphasized the importance of dynamic capabilities in enabling firms to respond effectively to digital disruption. Khitous et al. (2022) and D'Inverno et al. (2021) demonstrated that circular business models significantly improve organizational sustainability through business model innovation. Likewise, Becker et al. (2021), Tokazhanov et al. (2022), and Rödger et al. (2021) highlighted the importance of extending product life cycles to reduce resource exploitation and environmental impacts. Nevertheless, these studies provide limited explanations regarding how digital transformation strategies specifically drive circular economy implementation within resource-constrained small enterprises, leaving an important research gap requiring further investigation.

Addressing this gap, the present study introduces a novel perspective by conceptualizing digital transformation strategies as the primary drivers of circular economy practices among small enterprises. Unlike previous research that separately examines technological adoption or sustainability initiatives, this study proposes an integrated framework that positions digital transformation as the strategic mechanism connecting technological innovation, operational efficiency, resource optimization, waste management, and sustainable value creation (Edelson et al., 2021; Severengiz et al., 2020). This perspective enables a comprehensive understanding of how digital capabilities support the implementation of circular economy principles, including resource reduction, product reuse, material recycling, remanufacturing, and lifecycle optimization (Bag et al., 2022; Feijóo et al., 2023). Accordingly, the study contributes a state-of-

the-art conceptual approach that systematically explains the interaction between digital transformation strategies and circular economy practices within the context of small enterprise development.

Based on the foregoing discussion, the primary research problem concerns the limited utilization of digital transformation strategies as strategic enablers of circular economy implementation among small enterprises. Although digital technologies continue to advance rapidly, many firms remain unable to integrate digital solutions into production systems, logistics, resource management, waste recovery, and sustainable decision-making processes. Furthermore, empirical evidence explaining the mechanisms through which digital transformation enhances material efficiency, reduces environmental impacts, stimulates business model innovation, and simultaneously improves organizational sustainability remains insufficient. Consequently, this study seeks to answer the fundamental question of how digital transformation strategies facilitate the successful implementation of circular economy practices within small enterprises operating under technological, financial, and organizational constraints.

This study argues that integrated digital transformation strategies encompassing digital infrastructure, data-driven decision-making, process innovation, intelligent resource management, and digital collaboration constitute essential drivers of successful circular economy implementation in small enterprises. Beyond improving operational efficiency, digital transformation enhances supply chain transparency, extends product life cycles, optimizes resource utilization, minimizes waste generation, and supports the development of sustainable business models. The originality of this research lies in developing a comprehensive analytical framework that simultaneously integrates strategic digital transformation capabilities with multiple dimensions of circular economy practices. The findings are expected to enrich theoretical discussions on digital transformation and sustainability while providing practical guidance for policymakers, business leaders, and small enterprise managers seeking to accelerate sustainable economic development through digitally enabled circular business practices.

RESEARCH METHODS

This study employed a qualitative multiple-case study design to explore how digital transformation strategies drive circular economy practices among small enterprises(Halkias et al., 2022). A qualitative approach was selected because the research aimed to obtain an in-depth understanding of organizational experiences, managerial decision-making, technological adaptation, and sustainability practices that cannot be adequately explained through quantitative measurements. The multiple-case design enabled comparisons across different enterprises, allowing similarities, variations, and contextual influences to be identified systematically. This approach was considered appropriate because digital transformation and circular economy implementation are dynamic organizational phenomena influenced by social interactions, business environments, and strategic capabilities that require comprehensive interpretation within their real-world contexts.

The research was conducted in Probolinggo Regency, East Java, Indonesia, an area characterized by a growing number of digitally adaptive small enterprises and increasing governmental support for sustainable business development. The location was purposively selected because it represents an emerging ecosystem where digital innovation and environmental sustainability initiatives are simultaneously developing among local enterprises. Twenty-four informants participated in this study through purposive sampling. They consisted of twelve owners of manufacturing and service-based small enterprises, four digital business consultants, three local government officers responsible for enterprise development, three representatives from business associations, and two sustainability experts. Their diverse professional backgrounds provided comprehensive perspectives regarding digital transformation strategies and circular economy implementation.

Data were collected using multiple qualitative techniques to ensure comprehensive understanding and methodological triangulation (Chu et al., 2024). Semi-structured interviews served as the primary data source, enabling participants to describe their experiences, challenges, and strategic decisions regarding digital transformation and circular economy practices. Non-participant observations were conducted to examine production processes, digital technology utilization, waste management activities, and resource optimization practices within each enterprise. In addition, relevant organizational documents, sustainability reports, digital business records, policy documents, and supporting archival materials were reviewed to strengthen contextual understanding. Combining these complementary techniques facilitated richer data interpretation while improving the completeness and credibility of the research findings.

The collected data were analyzed using the interactive model proposed by Miles, Huberman, and Saldaña. The analysis began with data condensation, during which interview transcripts, observation notes, and documentary evidence were organized, coded, and simplified into meaningful analytical units (Kohn et al., 2024). Subsequently, data reduction was undertaken by categorizing similar concepts, identifying recurring patterns, and eliminating irrelevant information. The organized findings were then presented through thematic data displays, matrices, and conceptual relationships to facilitate interpretation. Finally, data verification was performed through continuous comparison, iterative interpretation, and conclusion drawing to ensure that emerging themes consistently reflected participants' experiences and accurately explained the relationship between digital transformation strategies and circular economy practices.

To ensure research trustworthiness, several validation procedures were implemented throughout the study (Kekeya, 2023). Credibility was strengthened through methodological triangulation involving interviews, observations, and document analysis, together with member checking to confirm the accuracy of participants' interpretations. Transferability was enhanced by providing detailed contextual descriptions of research settings, organizational characteristics, and participant backgrounds to facilitate comparison with similar contexts.

Dependability was ensured through systematic documentation of research procedures, coding decisions, and analytical processes using an audit trail. Confirmability was established by maintaining reflexive research notes, preserving documentary evidence, and conducting peer debriefing with qualitative research experts to minimize researcher bias and strengthen the consistency of research interpretations.

RESULTS AND DISCUSSION

Results

The findings reveal that digital transformation supports circular economy implementation through three interconnected dimensions: digital capability, data-driven innovation, and collaborative digital ecosystems. Together, these dimensions demonstrate how digital technologies extend beyond operational efficiency to enable sustainable resource management, evidence-based managerial decision-making, and network-based business collaboration. The following sections present the empirical findings and discuss their theoretical significance and practical implications within the context of small enterprise sustainability.

Digital Capability Enhances Circular Resource Management Efficiency

Field observations revealed that digital capability was operationally reflected in small enterprises' ability to integrate digital technologies into daily resource management activities, enabling more efficient production processes while supporting circular economy practices. Digital capability extended beyond technology ownership, encompassing the consistent use of digital tools to monitor raw materials, record production activities, track inventory, separate recyclable waste, and optimize reusable resources. The observed enterprises demonstrated varying levels of technological maturity, yet those with stronger digital capabilities consistently implemented more systematic resource management procedures. Operational activities became increasingly organized through digital recording systems, reducing unnecessary material consumption while improving production transparency, waste control, and overall resource efficiency across business operations.

Table 1. Observation Results of Digital Capability Supporting Circular Resource Management Efficiency

Observation Findings	Observed Indicator
Digital inventory system monitored raw material availability	Real-time inventory management
QR code labels attached to production materials	Digital traceability of resources
Tablet-based production recording used during operations	Digital production monitoring
Waste separated into recyclable and non-recyclable categories	Structured waste management
Reusable materials stored in designated digital-coded areas	Resource recovery practices
Production dashboard displays daily material consumption	Digital resource monitoring
Automatic stock updates synchronized with purchasing records	Integrated digital inventory

Production schedules managed through digital applications	Process automation efficiency
Remaining raw materials reallocated for subsequent production cycles	Circular resource utilization
Digital records documented material losses and recovery rates	Performance monitoring and evaluation

The observational evidence demonstrates that enterprises possessing stronger digital capabilities exhibited more structured and transparent resource management practices than those relying on conventional operational systems. The consistent use of digital inventory applications, production dashboards, QR-based tracking, and automated monitoring facilitated continuous supervision of material flows throughout production activities. The observation table indicates that digital technologies supported both operational efficiency and circular resource utilization by minimizing material losses, improving waste segregation, and maximizing reusable inputs. These findings reaffirm that digital capability functioned as an operational mechanism enabling enterprises to implement resource efficiency through systematic monitoring, accurate recording, and technology-assisted management practices observed directly during field activities.

Observation patterns consistently showed that digital capability was closely associated with increasingly organized circular resource management practices throughout production operations. Enterprises using integrated digital systems demonstrated clearer production workflows, more disciplined inventory control, and more systematic waste handling than enterprises employing manual procedures. Digital monitoring enabled immediate identification of excessive material usage, facilitating timely corrective actions before significant waste occurred. Furthermore, resource recovery activities became routine because reusable materials were digitally identified, categorized, and reintroduced into subsequent production cycles.

Data-Driven Innovation Strengthens Sustainable Business Operations

Field findings indicate that data-driven innovation was operationally reflected in managerial decisions that consistently relied on digital information rather than intuition alone when planning production, allocating resources, evaluating market demand, and improving operational sustainability. The observed enterprises collected business data from digital sales platforms, inventory systems, customer transactions, and production records before determining strategic actions. Rather than serving merely as administrative documentation, digital data became a strategic asset supporting business innovation and continuous operational improvement. Managers utilized these insights to identify inefficiencies, predict resource requirements, minimize production waste, and redesign business processes that simultaneously enhanced productivity, profitability, and long-term sustainability within increasingly dynamic competitive environments.

One enterprise owner explained, "We no longer determine production quantities based on estimation because the sales application provides weekly demand patterns that help us adjust production according to actual customer

needs. This approach has significantly reduced unused inventory and unnecessary material purchases." Another manager stated, "The digital dashboard allows us to compare production costs, sales performance, and material usage simultaneously, making it easier to identify inefficient processes and immediately revise operational decisions before losses become larger." These statements indicate that digital data has evolved into a managerial instrument supporting evidence-based decision-making. The researcher interprets that systematic access to business information encourages more adaptive innovations capable of improving both operational efficiency and environmental sustainability.

Another informant stated, "Customer purchasing history helps us identify products with stable demand, enabling us to prioritize resource allocation for items with the highest market potential while reducing overproduction of slower-moving products." A different participant explained, "Digital reports reveal where production waste frequently occurs, allowing us to redesign workflows and reuse remaining materials more effectively than before." These interview findings demonstrate that innovation emerged from continuous interpretation of operational data rather than isolated technological adoption. The researcher interprets that managerial learning became increasingly data-oriented, enabling enterprises to develop sustainable operational improvements through ongoing evaluation, informed decision-making, and continuous refinement of production processes supported by reliable digital information.

Field observations supported the interview findings by revealing the consistent use of digital sales dashboards, computerized inventory records, production monitoring applications, and electronic performance reports during daily business operations. Managers were repeatedly observed reviewing digital information before adjusting production schedules, ordering raw materials, and reallocating available resources. Operational decisions appeared closely connected to measurable business indicators rather than subjective assumptions. In summary, the evidence demonstrates that digital information served as the foundation for managerial innovation, enabling enterprises to respond more accurately to changing market conditions while improving production efficiency, reducing unnecessary resource consumption, strengthening business resilience, and supporting sustainable operational performance through informed strategic decision-making.

Collaborative Digital Ecosystems Accelerate Circular Economy Adoption

Field findings indicate that collaborative digital ecosystems were operationally reflected through the integration of small enterprises with dominant digital marketplace platforms that facilitated interactions among producers, consumers, suppliers, and logistics providers. Rather than functioning solely as online sales channels, digital marketplaces became collaborative environments where information, transactions, customer feedback, and operational coordination occurred simultaneously. This interconnected ecosystem enabled enterprises to improve product distribution, optimize inventory planning, respond rapidly to changing customer preferences, and

strengthen resource circulation throughout business activities. Consequently, circular economy adoption was supported not only by internal organizational capabilities but also by continuous collaboration within digitally connected business networks that enhanced sustainability-oriented operational performance.

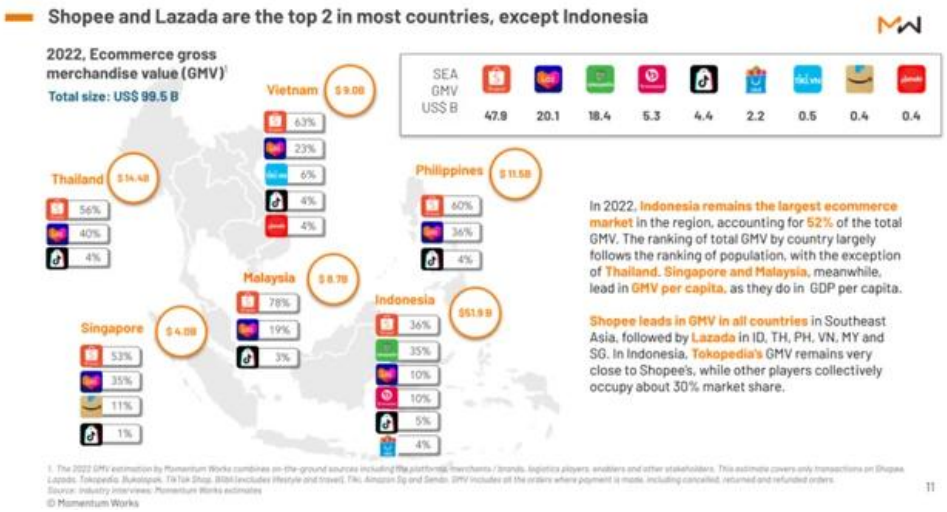

Figure 1. Documentation of Digital Marketplace Dominance Supporting Collaborative Digital Ecosystems

The documentary evidence used in this study consisted of the market share distribution of Indonesian e-commerce platforms, showing Shopee holding 36%, Tokopedia 35%, TikTok Shop 5%, Lazada 10%, Bukalapak 10%, and Blibli 4% of national e-commerce Gross Merchandise Value. This documentation illustrates that most digital commercial activities are concentrated within several interconnected marketplace ecosystems, providing small enterprises with access to extensive customer networks, digital payment systems, logistics integration, and real-time market information. The documented market structure shows that dominant digital platforms support collaborative digital ecosystems by facilitating sustainable business interactions and broader resource circulation.

The documentary evidence demonstrates that enterprises participating in dominant digital marketplace ecosystems gained broader opportunities to coordinate production activities with actual market demand while simultaneously strengthening collaboration with customers and business partners. The concentration of commercial transactions within several major marketplace platforms indicates that digital ecosystems provide an integrated infrastructure supporting communication, information exchange, logistics coordination, and digital transactions. The researcher interprets these interconnected digital environments as encouraging enterprises to optimize production planning, reduce excess inventory, and improve resource utilization based on continuously updated market information. Consequently, marketplace participation contributes not only to commercial expansion but also to more sustainable operational decision-making and circular business implementation.

In summary, the documentary evidence confirms that collaborative digital ecosystems function as enabling infrastructures that accelerate circular economy adoption among small enterprises. The dominance of several digital marketplace platforms illustrates that sustainability-oriented business practices increasingly depend on network connectivity rather than isolated organizational efforts. A consistent pattern emerged in which centralized digital platforms facilitated information sharing, customer interaction, transaction management, and operational coordination within one integrated ecosystem. These conditions strengthened enterprise adaptability while improving production efficiency and resource circulation. Overall, the documented market structure indicates that collaborative digital ecosystems provide an important institutional foundation for accelerating circular economy implementation through digitally connected business relationships and coordinated value creation.

Discussion

The findings demonstrate that digital capability serves as the operational foundation for implementing circular resource management within small enterprises. The observation that digitally enabled inventory systems, production monitoring, and resource traceability reduced material waste is consistent with previous studies emphasizing that digital technologies enhance organizational efficiency and sustainability (Yin et al., 2021; Zheng et al., 2022). However, the present findings extend existing knowledge by showing that digital capability not only automates operational processes but also institutionalizes circular resource management through continuous monitoring and systematic material recovery. Basically, this broadens the understanding of digital transformation as a strategic capability supporting circular economy implementation rather than solely improving technological efficiency (Shevchenko et al., 2021; Velde et al., 2024).

The second finding indicates that data-driven innovation strengthens sustainable business operations by transforming digital information into strategic managerial knowledge. This result supports previous research arguing that organizational performance improves when business decisions rely on analytical information rather than managerial intuition (Durge et al., 2021; Firouzi et al., 2022). Nevertheless, this study reveals a more dynamic mechanism in which operational data continuously stimulates process innovation, production redesign, and resource optimization within small enterprises. Rather than functioning as passive business records, digital data actively shapes organizational learning and adaptive decision-making (Chaika, 2025; MacLean, 2021). Theoretically, this finding reinforces the relationship between data capability and sustainable innovation, while practically encouraging enterprises to develop analytical competencies that convert operational information into continuous, sustainability-oriented business improvements.

Another important finding demonstrates that collaborative digital ecosystems accelerate circular economy adoption by connecting enterprises with customers, suppliers, logistics providers, and digital marketplace platforms. Previous studies generally acknowledge that digital platforms facilitate business

expansion and customer engagement (Cowley et al., 2021; Franco et al., 2021; Nkoala et al., 2023). However, the present findings indicate that marketplace ecosystems contribute beyond commercial transactions by supporting information exchange, production coordination, and resource circulation across interconnected business networks. This interpretation expands current theoretical discussions by positioning digital ecosystems as collaborative infrastructures that enable circular economy implementation, rather than merely functioning as electronic marketing channels (Al-kfairy et al., 2024; Saifullah et al., 2024). Specifically, policymakers should strengthen digital ecosystem development through integrated marketplace support, digital infrastructure, and collaborative innovation programs for small enterprises.

Taken together, the three findings illustrate that successful circular economy implementation depends on the interaction between organizational digital capability, evidence-based managerial innovation, and collaborative digital ecosystems. Existing literature frequently examines these dimensions independently, resulting in fragmented explanations regarding sustainable digital transformation. In contrast, this study demonstrates that digital capability creates operational readiness, data-driven innovation improves strategic decision-making, and collaborative ecosystems extend sustainability practices across business networks. This integrated perspective contributes theoretically by proposing a multidimensional explanation of digitally enabled circular economy implementation. Practically, enterprise development initiatives should simultaneously strengthen technological capability, managerial analytics, and external digital collaboration rather than emphasizing only technology adoption.

Overall, this study contributes to the growing discourse on digital transformation by demonstrating that sustainable business development emerges from integrating technological resources, managerial intelligence, and collaborative digital networks. Unlike previous studies that primarily associate digital transformation with productivity enhancement, the present findings reveal that it also catalyzes circular economy practices through efficient resource utilization, adaptive innovation, and ecosystem-based collaboration. These findings provide an expanded conceptual understanding of digitally enabled sustainability while offering practical guidance for governments, business associations, and enterprise managers seeking to accelerate circular economy implementation through comprehensive digital transformation strategies that integrate organizational, technological, and institutional dimensions.

CONCLUSION

This study concludes that digital transformation functions as a strategic enabler of circular economy implementation among small enterprises through the integration of digital capability, data-driven innovation, and collaborative digital ecosystems. The most important finding demonstrates that sustainable business practices emerge not from technology adoption alone but from the effective alignment of digital resources, managerial decision-making, and stakeholder collaboration. The study contributes theoretically by proposing an integrated qualitative perspective explaining how digital transformation simultaneously strengthens operational efficiency, resource circulation, and

sustainability-oriented business performance. Nevertheless, the research is limited to qualitative evidence from a specific regional context. Future studies should employ mixed-method or longitudinal approaches across broader industrial sectors to validate and extend the proposed conceptual framework.

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REFERENCES

Al-kfairy, M., Alomari, A., Al-Bashayreh, M., Alfandi, O., & Tubishat, M. (2024). Unveiling the Metaverse: A Survey of User Perceptions and the Impact of Usability, Social Influence and Interoperability. In *Heliyon* (Vol. 10, Issue 10). https://doi.org/10.1016/j.heliyon.2024.e31413

Alvarado, R., Deng, Q., Chamba, J., Alvarado-Lopez, M., & Ahmad, M. (2021). Do Economic Development and Human Capital Decrease Non-Renewable Energy Consumption? Evidence for OECD Countries. *Energy*, *215*. https://doi.org/10.1016/j.energy.2020.119147

Arestis, P., Ferreiro, J., & Gomez, C. (2023). Does Employment Protection Legislation Affect Employment and Unemployment? *Economic Modelling*, *126*. https://doi.org/10.1016/j.econmod.2023.106437

Bag, S., & Pretorius, J. H. C. (2022). Relationships between Industry 4.0, Sustainable Manufacturing and Circular Economy: Proposal of a Research Framework. In *International Journal of Organizational Analysis* (Vol. 30, Issue 4, pp. 864–898). https://doi.org/10.1108/IJOA-04-2020-2120

Barbieri, P., & Cutuli, G. (2021). Italy: Labour Market De-Regulation, Unemployment Risks and Temporary Employment Growth. Lessons from the Past for the Present COVID-19 Crisis. *Stato e Mercato*, *41*(2), 177–199. https://doi.org/10.1425/102022

Becker, T., Bruns, B., Lier, S., & Werners, B. (2021). Decentralized Modular Production to Increase Supply Chain Efficiency in Chemical Markets: An Example of Polymer Production. *Journal of Business Economics*, *91*(6), 867–895. https://doi.org/10.1007/s11573-020-01019-4

Chaika, O. (2025). Educational Policy and Reforms: the Impact of Globalization. In *Educational Policy and Reforms: the Impact of Globalization*. https://doi.org/10.15587/978-617-8360-20-7

Chu, H. C., Chang, M. K., & Chen, Y. C. (2024). Meta-Analysis of Emotional Labor. *Bulletin of Educational Psychology*, *55*(4), 847–874. https://doi.org/10.6251/BEP.202406_55(4).0009

Cifone, F. D., Hoberg, K., Holweg, M., & Staudacher, A. P. (2021). 'Lean 4.0': How can Digital Technologies Support Lean Practices? *International Journal of Production Economics*, *241*. https://doi.org/10.1016/j.ijpe.2021.108258

Cowley, S., Humphrey, W., & Muñoz, C. (2021). Industry Certifications in Digital Marketing and Media Education: An Examination of Perceptions and Use Among Educators. *Journal of Marketing Education*, *43*(2), 189–203. https://doi.org/10.1177/0273475320948570

D'Inverno, G., Carosi, L., & Romano, G. (2021). Environmental Sustainability and Service Quality Beyond Economic and Financial Indicators: A Performance Evaluation of Italian Water Utilities. *Socio-Economic Planning Sciences*, *75*. https://doi.org/10.1016/j.seps.2020.100852

Durge, N. K., Mantha, S. S., & Phalle, V. M. (2021). Interpretive Structural Modeling (ISM) for Analysis of Factors Affecting Marketing Efficiency of Fresh Mango Supply Chain: Indian Perspective. *International Journal of Supply and Operations Management*, *8*(4), 416–438. https://doi.org/10.22034/IJSOM.2021.4.4

Edelson, J. R., Struble, M., Magan, R., & Saterbak, A. (2021). Integration of Ethics-Focused Modules into the Steps of the Engineering Design Process. In *ASEE Annual Conference and Exposition, Conference Proceedings*. https://doi.org/10.18260/1-2--37367

Feijóo, C., Armuña, C., & Díaz, J. F. (2023). China's International Perspective on Education and Edtech. In *China and International Norms: Evidence from the Belt and Road Initiative* (pp. 111–133). https://doi.org/10.4324/9781003299387-6

Fernández;, S. S. (2021). Islamic Fintech. In *Islamic Fintech*. https://doi.org/10.4324/9781003014614

Firouzi, F., Farahani, B., Barzegari, M., & Daneshmand, M. (2022). AI-Driven Data Monetization: The Other Face of Data in IoT-Based Smart and Connected Health. *IEEE Internet of Things Journal*, *9*(8), 5581–5599. https://doi.org/10.1109/JIOT.2020.3027971

Franco, S., Presenza, A., & Petruzzelli, A. M. (2021). Boosting Innovative Business Ideas Through Hackathons. The "Hack for Travel" case study. *European Journal of Innovation Management*, *25*(6), 413–431. https://doi.org/10.1108/EJIM-06-2021-0300

Halkias, D., Thurman, P. W., & Harkiolakis, N. (2022). The Multiple Case Study Design: Methodology and Application for Management Education. In *The Multiple Case Study Design: Methodology and Application for Management Education*. Routledge. https://doi.org/10.4324/9781003244936

Jeswani, H., Krüger, C., Russ, M., Horlacher, M., Antony, F., Hann, S., & Azapagic, A. (2021). Life Cycle Environmental Impacts of Chemical Recycling Via Pyrolysis of Mixed Plastic Waste in Comparison with Mechanical Recycling and Energy Recovery. *Science of the Total Environment*, *769*. https://doi.org/10.1016/j.scitotenv.2020.144483

Jovkovska, A. S. (2023). Report on Smart Education in the Republic of North Macedonia. In *Lecture Notes in Educational Technology* (pp. 235–269). https://doi.org/10.1007/978-981-19-7319-2_10

Kazancoglu, Y., Ozkan-Ozen, Y. D., Sagnak, M., Kazancoglu, I., & Dora, M. (2023). Framework for a Sustainable Supply Chain to Overcome Risks in Transition to a Circular Economy Through Industry 4.0. *Production Planning and Control*, *34*(10), 902–917. https://doi.org/10.1080/09537287.2021.1980910

Kekeya, J. (2023). Qualitative Case Study Research Design : The Commonalities and Differences between Collective, Intrinsic and Instrumental Case Studies. *Contemporary PNG Studies*, *36*(2008), 29–30. https://doi.org/10.3316/informit.356219476950585

Khitous, F., Urbinati, A., & Verleye, K. (2022). Product-Service Systems: A Customer Engagement Perspective in the Fashion Industry. *Journal of Cleaner Production*, *336*. https://doi.org/10.1016/j.jclepro.2022.130394

Kohn, L., & Christiaens, W. (2024). Qualitative Research Methods: Contributions and Beliefs. *Reflets et Perspectives de La Vie Economique*, *53*(4), 67–82. https://doi.org/10.3917/rpve.534.0067

Krishna, S. H., Kaur, K., Rajalakshmi, B., Lakhanpal, S., Sule, B., & Sumalatha, I. (2024). Competitive Edge Using Big Data Analytics to Improve Customer Relationship Management. In *Proceedings of International Conference on Communication, Computer Sciences and Engineering, IC3SE 2024* (pp. 1553–1557). https://doi.org/10.1109/IC3SE62002.2024.10593152

Lakshmi, V. & Boopathi, S. (2024). Circular Economy Digital Practices for Ethical Dimensions and Policies for Digital Waste Management. In *Harnessing High-Performance Computing and AI for Environmental Sustainability* (pp. 166–193). https://doi.org/10.4018/979-8-3693-1794-5.ch008

Li, G., & Wei, W. (2021). Financial Development, Openness, Innovation, Carbon Emissions, and Economic Growth in China. *Energy Economics*, *97*. https://doi.org/10.1016/j.eneco.2021.105194

MacLean, S. (2021). A Conceptual Continuous Improvement Framework to Examine the "Problems of Understanding" Applied Research. *Higher Learning Research Communications*, *11*(2), 1–21. https://doi.org/10.18870/hlrc.v11i2.1252

Meshalkin, V. P., Burukhina, T. F., & Khodchenko, S. M. (2021). State of the Art and Research Development Prospects of Energy- and Resource-Efficient, Environmentally Safe Chemical Process Systems Engineering. In *Mendeleev Communications* (Vol. 31, Issue 5, pp. 593–604). https://doi.org/10.1016/j.mencom.2021.09.003

Nkoala, S., Magoda, Z., Makwambeni, B., Mshayisa, V., & Mugobo, V. (2023). Use of Digital Tools for Social Engagement in Remote Learning during the COVID-19 Pandemic: A Case Study of a South African University. *International Journal of Education and Development Using Information and Communication Technology*, *19*(1), 61–79.

Pavlenko, V., Chorna, O., Morhulets, O., & Pylypenko, V. (2023). Creating Educational Products Using Data Science and Digital Marketing. In *2023 IEEE 4th KhPI Week on Advanced Technology, KhPI Week 2023 - Conference Proceedings*. https://doi.org/10.1109/KhPIWeek61412.2023.10312906

Rababah, A., Alkasasbeh, I., & Khan, A. A. (2024). Environmental Factors and Risks Affecting the Adoption of E-Wallets By Small and Medium-Sized

Enterprises During Disasters: the Case of the COVID-19 Pandemic. *Risk Governance and Control: Financial Markets and Institutions*, *14*(4), 78–88. https://doi.org/10.22495/rgcv14i4p8

Rödger, J. M., Beier, J., & Hauschild, M. Z. (2021). Combining Life Cycle Assessment and Manufacturing System Simulation: Evaluating Dynamic Impacts from Renewable Energy Supply on Product-Specific Environmental Footprints. *International Journal of Precision Engineering and Manufacturing - Green Technology*, *8*(3), 1007–1026. https://doi.org/10.1007/s40684-020-00229-z

Saifullah, K., Khan, M. I., Jamal, S., & Sarker, I. H. (2024). Cyberbullying Text Identification: A Deep Learning and Transformer-based Language Modeling Approach. *EAI Endorsed Transactions on Industrial Networks and Intelligent Systems*, *11*(1), 1–12. https://doi.org/10.4108/EETINIS.V11I1.4703

Severengiz, S., Schelte, N., & Bracke, S. (2020). Analysis of the Environmental Impact of E-Scooter Sharing Services Considering Product Reliability Characteristics and Durability. In *Procedia CIRP* (Vol. 96, pp. 181–188). https://doi.org/10.1016/j.procir.2021.01.072

Shevchenko, T., Saidani, M., Danko, Y., Golysheva, I., Chovancová, J., & Vavrek, R. (2021). Towards a Smart E-Waste System Utilizing Supply Chain Participants and Interactive Online Maps. *Recycling*, *6*(1), 1–14. https://doi.org/10.3390/recycling6010008

Tokazhanov, G., Turkyilmaz, A., & Karaca, F. (2022). Circularity Assessment Tool Development for Construction Projects in Emerging Economies. *Journal of Cleaner Production*, *362*. https://doi.org/10.1016/j.jclepro.2022.132293

Velde, S., Sresakoolchai, J., & Kaewunruen, S. (2024). Balancing Emerging Risks Considering the Life-Cycle Perspectives of Submerged Floating Tunnels for a Resilient Future Infrastructure. *Sustainability (Switzerland)*, *16*(13). https://doi.org/10.3390/su16135596

Yin, C., Zhao, W., Cherubini, F., & Pereira, P. (2021). Integrate Ecosystem Services into Socio-Economic Development to Enhance Achievement of Sustainable Development Goals in the Post-Pandemic Era. *Geography and Sustainability*, *2*(1), 68–73. https://doi.org/10.1016/j.geosus.2021.03.002

Zheng, K., Zheng, L. J., Gauthier, J., Zhou, L., Xu, Y., Behl, A., & Zhang, J. Z. (2022). Blockchain Technology for Enterprise Credit Information Sharing in Supply Chain Finance. *Journal of Innovation and Knowledge*, *7*(4). https://doi.org/10.1016/j.jik.2022.100256

Zhou, X., Pan, C. L., Feng, Y., & Bu, M. (2021). Smart Customer Experience of ESG Education Capability Building Roadmap for Smart Consulting, Reporting and Engaging for Carbon Peak and Carbon Neutrality Goals. In *Proceedings - 2021 3rd International Conference on Internet Technology and Educational Informization, ITEI 2021* (pp. 333–336). https://doi.org/10.1109/ITEI55021.2021.00083