



Digital Transformation as a Structural Enabler of Zero-Carbon Mobility: A Practice Perspective from Emerging Economies

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Abstract

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This research aims to explain how digital transformation plays a role as a structural enabler in accelerating the transition to zero-carbon mobility. This study examines the real-world practices of digital technology adoption in the sustainable transportation sector by highlighting how industry actors are navigating the challenges of decarbonization, governance, and cross-sector collaboration. This study uses a practice perspective approach, which emphasizes analysis of the empirical practices of industry players, regulators, and digital service providers. Two main case studies—Gojek and Blue Bird Group—were selected to illustrate the strategic implementation of digitalization through route optimization, fleet electrification, predictive maintenance systems, and the use of real-time telematics. The analysis was carried out qualitatively based on secondary data triangulation and literature synthesis. The results show that digitalization significantly reduces carbon intensity and improves operational efficiency, but is still faced with obstacles in the form of infrastructure inequality, initial investment costs, and digital literacy gaps. The success of the green mobility transition is proven to depend on the synergy between technological innovation, digital governance, and multi-stakeholder collaboration. These findings provide strategic implications for policymakers and industry players to design digital policies and ecosystems that are inclusive, data-driven, and aligned with the Net Zero Emission 2060 agenda. The study also expands the literature by showing how digitalization integration can strengthen sustainability capabilities in the context of emerging economies.

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INTRODUCTION

The global transition to zero-carbon mobility has become an important pillar in realizing sustainable development and carbon neutrality (Geels et al., 2016; He et al., 2022). Since the Paris Agreement in 2015 and strengthened through the Net Zero

Emissions 2050 target, various countries have accelerated efforts to decarbonize the transportation sector which is one of the largest contributors to greenhouse gas emissions in the world with a contribution of around 23% to total global emissions (He et al., 2022). However, the achievement of a carbon-neutral transportation system does not only depend on the electrification of vehicles, but also on structural transformations in the energy supply chain, digital infrastructure, and changes in social behavior (Arent et al., 2022). The well-to-wheel paradigm asserts that decarbonization cannot be achieved simply by changing vehicle types, but demands synergies between renewable energy adoption, data optimization, and integrated mobility management (Krause et al., 2024).

Despite the growing global momentum towards decarbonization, developing countries face an implementation gap between sustainability policies and real practices on the ground (Leal Filho et al., 2025). In many cases, the electrification and digitalization process takes place unevenly due to regulatory fragmentation, limited infrastructure, and disparities in digital readiness. Previous studies have mostly focused on theoretical models and sustainable transport policies (Chen, 2023; Geels et al., 2016). Meanwhile, empirical evidence on how organizations and governments implement low-carbon strategies based on digital transformation is limited (Chen, 2023). This gap is particularly relevant in the context of Southeast Asia, particularly Indonesia, which is facing a dual challenge: expanding the electric vehicle ecosystem while building digital and social readiness to support the transition to sustainable mobility.

To address this gap, this study aims to explore how digital transformation acts as an enabler for the creation of low-carbon mobility systems through a practice-based approach in Indonesia. This study examines two main case studies, Gojek and Blue Bird Group to understand how digital technologies such as the Internet of Things (IoT), route optimization algorithms, fleet electrification, and data analysis are applied in an effort to reduce emissions and improve operational efficiency (Infrastructure, 2024). The goal is not only to map the impact of technology, but also to uncover the social, institutional, and collaborative dynamics that influence its implementation from investment barriers, user adaptation, to cross-sector collaboration.

The practice perspective approach is used to provide an analytical lens that is oriented towards empirical reality. As argued by Geels et al. (2016) and Bhatt et al. (2025) this approach bridges the gap between policy idealism and operational practice by emphasizing how actors—whether governments, corporations, or digital innovators—collectively shape value and meaning through their daily actions. In the context of zero-carbon mobility in Indonesia, this perspective allows for a deeper understanding of how industry players navigate the tensions between the global narrative of sustainability and local challenges such as limited charging infrastructure, consumer behavioral resistance, and adaptation of foreign technologies to domestic contexts (Zahari & McLellan, 2024).

This research makes two main contributions. First, it theoretically expands the understanding of the interconnectedness between digital transformation and sustainable transportation by affirming the function of digitalization as a structural enabler in accelerating the low-carbon transition in developing countries (Infrastructure, 2024). Second, it practically offers strategic insights for policymakers and industry players in designing an inclusive and data-driven sustainability ecosystem (Bibri, 2021). Furthermore, the article is structured as follows: Part 2 presents a conceptual overview of zero-carbon mobility and digital transformation; Part 3 outlines the Indonesian context; Sections 4 discuss practical case studies; Section 5 examines managerial implications;

and Section 6 concludes with policy recommendations as well as future research directions.

LITERATURE REVIEW

Zero Carbon Mobility Concept

The concept of zero carbon mobility is a new paradigm in sustainable development that emphasizes the achievement of carbon neutrality in all transportation sectors, both land, sea, and air (Zahari & McLellan, 2024). This idea is rooted in the global commitment to decarbonization, as stated in the 2015 Paris Agreement and strengthened by the Net Zero Emissions 2050 target adopted by various countries, including Indonesia. According to a report by the International Energy Agency, the transportation sector contributes around 23% to total global carbon emissions, so the transformation towards a low-carbon mobility system is a key element in climate change mitigation (Küfeoğlu, 2024).

Conceptually, zero carbon mobility is not only oriented towards reducing the direct emissions generated by vehicles, but also includes indirect emissions from the energy supply and production chains (Küfeoğlu, 2024). This approach is known as the well-to-wheel framework, which assesses carbon impacts from the fuel production process to final consumption by vehicles (Krause et al., 2024). Therefore, transportation electrification must be accompanied by the transition of energy sources to renewable energy in order to truly achieve carbon neutral conditions (Zahari & McLellan, 2024). In this context, decarbonization efforts involve two main strategies: first, replacing fossil fuels with clean energy such as electricity, hydrogen, and biofuels; and second, optimizing energy efficiency through technological innovation and digitizing transportation management systems (Arent et al., 2022).

Globally, the zero carbon mobility paradigm is often associated with the Avoid–Shift–Improve (ASI) approach (Bhatt et al., 2025). This approach encourages reduced travel needs (avoid), shift to public or low-emission modes of transportation (shift), and increased efficiency through technology and clean energy systems (improve). This model is the main operational framework for European and East Asian countries in designing green mobility policies (Watson, 2012). In Indonesia itself, the shift towards low-carbon transportation is beginning to be realized through the implementation of electric vehicles, modernization of public transportation, and the digitalization of urban traffic management (Zahari & McLellan, 2024). Thus, the concept of zero carbon mobility is not just a normative ideal, but a foundation for structural transformation towards an efficient, clean, and environmentally just transportation system.

Digital Transformation in Sustainable Transport

Digital transformation is the main catalyst in accelerating the implementation of zero carbon mobility. The integration of digital technologies such as the Internet of Things (IoT), Artificial Intelligence (AI), big data analytics, and cloud computing enables transportation systems to operate smarter, more efficiently, and with lower emissions. In a study by Infrastructure (2024), digitalization in the transportation sector has been proven to reduce carbon intensity through route optimization, predictive maintenance, and data-driven energy management. This technology not only improves operational efficiency,

but also changes the paradigm of decision-making from intuition-based to data-driven decision-making.

One of the most significant applications of digital transformation is the use of route optimization algorithms and real-time traffic analytics systems that are able to reduce mileage and travel time, while lowering fuel consumption (Fatorachian & Kazemi, 2025). Empirical studies in the European Union show that Mobility-as-a-Service (MaaS) systems that integrate the digitalization of public transport are able to reduce emissions by up to 20% through increased vehicle movement efficiency and reduced use of private vehicles (Barreto et al., 2020).

Similarly, the China Smart Transport Strategy initiative has succeeded in reducing the carbon emissions of the urban transportation sector by 15–18% thanks to the application of sensor and machine learning technologies in traffic management (Khan et al., 2025).

In addition to operational optimization, digitalization also plays an important role in predictive maintenance systems that allow transportation companies to continuously monitor vehicle conditions and perform maintenance before damage occurs (Barreto et al., 2020). This approach saves energy and maintenance costs while reducing indirect emissions due to downtime. Furthermore, the concept of digital twins, which is a virtual simulation of a real transportation system, has emerged, which is used to analyze energy consumption patterns and identify the best efficiency strategies (Infrastructure, 2024).

Nevertheless, the effectiveness of digital transformation is highly dependent on the readiness of infrastructure, human resources, and regulatory frameworks. In developing countries, challenges such as the digital divide, high investment costs, and policy fragmentation remain major obstacles (Watson, 2012). Even so, empirical evidence shows that digitalization remains a strategic enabler that accelerates the transition to low-carbon mobility systems, both through technological innovation and changes in user behavior that are increasingly driven by a green-oriented digital ecosystem (Barreto et al., 2020).

Practice Perspective Approach

In examining the transformation towards zero carbon mobility, the practice perspective approach provides a more realistic and applicable perspective than the purely theoretical approach (Watson, 2012). This approach emphasizes the importance of understanding the real practices carried out by industry players, governments, and user communities in the process of implementing green policies and innovations. As explained by Fatorachian and Kazemi (2025), practice is a structured and meaningful set of social actions, in which values, habits, and technology interact with each other to form patterns of change in the real world.

In the context of sustainable transportation, this approach allows researchers to capture the dynamics of collaboration between governments as regulators, corporations as business actors, and startups as technology innovators (Zahari & McLellan, 2024). This kind of collaboration, as discovered by Watson (2012). It is an important catalyst in creating shared value that combines profitability and environmental sustainability. The practical approach also allows for exploration of local adaptation—how global digital solutions are modified according to the social, economic, and technical context of a region, just as the adoption of electric vehicles in Indonesia must take into account energy infrastructure and domestic consumer preferences.

Furthermore, practice in the field often reveals the interaction between policy idealism and operational reality. For example, companies such as Gojek and Bluebird that implement fleet electrification strategies must face the challenges of high investment costs, limited charging infrastructure, and consumer resistance to behavioral changes (Anugrah et al., 2025). Practice-based analysis helps uncover how those actors navigate that complexity through digital innovation, cross-sector collaboration, and green marketing campaigns. Thus, this approach not only records what is done, but also why the action is done and how it creates a real transformation.

Through the integration of decarbonization theory, digital innovation, and practical approaches, the literature on zero carbon mobility forms a strong conceptual foundation for understanding the sustainable mobility transition in Indonesia. The practical perspective asserts that the success of the transition is determined not only by policies and technology, but also by the way actors on the ground articulate sustainability values into concrete actions that can be replicated and measured in impact on emissions reductions (Bhatt et al., 2025).

RESEARCH CONTEXT: INDONESIA

In recent years, Indonesia has witnessed a marked acceleration in the adoption of electric vehicles (EVs) and the use of online mobility platforms. According to data from the Ministry of Energy and Mineral Resources, until July 2025 the number of SPKLU (Public Electric Vehicle Charging Stations) has reached more than 4,186 units, as one of the efforts to strengthen the public charging ecosystem amid a surge in the domestic EV market (ESDM, 2025). Previously, at the end of 2023, there were around 1,081 SPKLU units spread across various locations in Indonesia, which shows an escalation of charging infrastructure capacity since then.

Meanwhile, in the electric car market itself, the growth trend is striking. Battery electric car (BEV) sales in the first seven months of 2025 were recorded close to total sales throughout 2024, signaling strong momentum in consumers' shift to green vehicles. Furthermore, the ICCT reported that national electric vehicle sales jumped from tens of units in 2020 to tens of thousands of units in 2024, largely triggered by government policies supporting the electric transition (Rajendra, 2025).

The regulatory foundation is also increasingly strengthened. Presidential Regulation No. 55 of 2019 is the main umbrella for the acceleration of electric vehicles (KBLBB) in Indonesia, establishing a framework for fiscal and non-fiscal incentives as well as the obligation to develop SPKLU infrastructure (PP55, 2019). On the other hand, the *Indonesia Sustainable Mobility Outlook 2025 report* highlights that many policies to support sustainable mobility are already available, including the acceleration of BEVs and the development of public transportation, but their implementation is still fragmented or not optimal (ISMO, 2025).

Although the construction of SPKLU continues to advance, the distribution is still far from even. Java remains the center of charging infrastructure density, while areas outside Java—for example, Sulawesi, Nusa Tenggara, and Papua—are still relatively underserved. In addition, the Ministry of Energy and Mineral Resources revealed that most SPKLU still relies on electricity from coal-fired plants, which raises an irony: although the operational vehicles are low-carbon, the energy sources are not all clean (ESDM, 2025).

Financial and investment challenges are also significant obstacles. Since the initial cost of SPKLU construction and EV fleet renewal is relatively high, investors tend to prioritize areas with higher user densities and lower investment risks. In remote areas or medium-sized cities, the uncertainty of demand and the burden of local infrastructure is often a barrier.

In addition, the digital divide between regions has complicated the transition to integrated electric mobility. Essential services such as charging applications, fleet management systems, *smart charging*, and real-time monitoring systems rely on uneven communication networks and data processing capacity. In areas with weak connectivity or low digital literacy, the operation of digital mobility models has the potential to be held back or fail to be adopted by the community.

Thus, Indonesia's current context is at a tipping point: a combination of a maturing market, grounded regulatory thrust, and ever-evolving infrastructure. However, the long-term success of the transition to zero-carbon mobility will depend heavily on the ability to overcome the uneven distribution of charging infrastructure, high initial investment pressures, and the digital gap between regions so that this transformation can be fair and effective across the archipelago.

PRACTICE CASES

One of the most representative examples of the digital transformation towards low-carbon mobility in Indonesia can be seen in Gojek's efforts to convert its fleet to electric vehicles. Gojek announces ambitious commitment that all partner two-wheelers will be replaced to become an electric vehicle by 2030. In this context, Gojek and TBS Energi Utama formed a joint venture called *Electrum* to produce and support the local two-wheeled EV ecosystem—including battery packaging, battery swap station presence, and EV ownership financing (Nabila, 2025).

On the operational side, Gojek claims that their EV fleet has increased significantly—according to reports, by 2025 Gojek's electric vehicle fleet will grow by around 300% compared to the previous internal target.

However, this transformation also features complex dynamics. Gojek had collaborated with Gogoro (Taiwan) to test a *battery swapping scheme* for two-wheeled vehicles in Jakarta, but then the collaboration conflicted and was partially dissolved, marking the challenge of integrating foreign technologies in the local context. The pilot project was originally designed to introduce a network of battery swap stations as a quick recharge solution, so users don't have to rely on conventional battery charging (Nabila, 2025). Cases like these are particularly relevant to the practical approach because they present real conditions: investment decisions, local technical adaptations, and negotiations between foreign technology ecosystems and local needs.

Another case that shows both challenges and opportunities is the transformation journey of Blue Bird Group, Indonesia's legendary taxi company. In recent years, Blue Bird has affirmed a growth vision that is aligned with digitalization and sustainability. In 2023, the company launched its "3M" strategy (multi-product, multi-channel, multi-payment) as part of its vision to become a modern mobility company (Bluebird, 2024). Under the strategy, Blue Bird also sets a goal to significantly reduce waste and emissions towards 2030. In line with this vision, by 2025 Blue Bird targets the integration of 1,000 units of electric vehicles into its fleet, up from around 300 units that have been realized

previously About half of the additions are planned to be operational in the first half of 2025. bluebird 2024

The selection of electric vehicle brands is also a strategic part of Blue Bird's transformation. The majority of new EV units are targeted to come from BYD, with an estimated 80% of new EV orders this year coming from the brand, for cost efficiency and production scale. This commitment is also in line with BYD's entry into the Indonesian market and the expectation that their presence will reduce EV prices and increase mass adoption. Blue Bird stated that it will prioritize automotive manufacturers with local manufacturing facilities to support the domestic ecosystem, both in the supply of vehicles and components (Bluebird, 2024).

What's interesting about Blue Bird's case is how digital and sustainability initiatives are positioned in parallel, reinforcing each other. In addition to fleet replacement, the digitalization of taxi operations—including booking platforms, real-time fleet management, route optimization within the city, and digital payment integration—is an integral part of the transformation strategy (Fajar et al., 2025). When the pandemic hit the transportation industry, Blue Bird revitalized its revenue by expanding its business lines (car rentals, shuttle services) and strengthening its digital capabilities so that during economic recovery, the company is in a more adaptive position.

Through the two case studies (Gojek and Blue Bird), it can be seen that the digital transformation towards low-carbon mobility does not take place unilaterally. Strategic decisions for EV fleet conversion should consider the readiness of the supporting ecosystem (charging infrastructure, battery supply, charging logistics), investment costs, and user adoption. In addition, the adaptation of foreign technology to the local environment, consumer preferences, and local regulations are important variables that must be formulated in practice. The depth of the practical approach allows us to understand how actors on the ground articulate realistic green transformation strategies, rather than just normative plans.

DISCUSSION AND IMPLICATIONS

Indonesia's transformation towards *zero-carbon mobility* features a convergence of digital innovation, public policy, and green business strategies. Two case studies—Gojek and Blue Bird—show that the success of decarbonization initiatives depends not only on the technical capabilities to switch to electric vehicles, but also on digital *governance*, ecosystem management, and sustainability narratives built at the organizational level. In this context, digital transformation is not just a tool of efficiency, but a strategic foundation to build the legitimacy of the green economy and foster public trust in corporate sustainability commitments (Geels et al., 2016).

Digitalization as a Structural Enabler of Low-Carbon Mobility

Digitalization has become a *structural enabler* that enables the simultaneous integration of various aspects of green mobility—from route planning, energy management, to user experience. In the case of Gojek, the implementation of route optimization algorithms and *real-time telematics* reduces operational energy consumption while increasing service efficiency. This system shortens the mileage per order and reduces the emission of active vehicles on the road. Digitalization also expands opportunities for cross-sectoral collaboration—such as *battery swap integration* with

local energy providers—which fundamentally strengthens the efficiency of the electric energy supply chain.

Meanwhile, Blue Bird points out that digitalization not only improves operational efficiency but also becomes a medium to communicate the value of sustainability to consumers. The integration of digital booking systems, *cashless payments*, and fleet carbon reporting is creating a new form of corporate transparency, where consumers can assess the environmental impact of their mobility choices. Thus, digitalization becomes a bridge between technology aspects and green *value perception*, which strengthens reputational advantage and market trust.

In a theoretical context, these results confirm that digital transformation plays a role as *a strategic complement* to decarbonization efforts (Huang & Lin, 2023). Digital technology is accelerating the energy transition by creating a data flow that enables *evidence-based sustainability management*, replacing traditional reactive and intuitive decision patterns.

Challenges of Institutional and Infrastructural Readiness

Despite the high potential for digitalization, institutional and infrastructure challenges remain significant. As found in the context of Gojek and Blue Bird, the success of EV initiatives is greatly influenced by the readiness of *the charging ecosystem*, coordination between regulators, and harmonization of fiscal policies. The limited distribution of SPKLU outside urban areas creates a risk of *range anxiety* for drivers, which in turn slows down the scale of adoption of EV fleets in the commercial sector.

From an institutional perspective, policy fragmentation between sectors also shows inconsistencies. Although Presidential Regulation No. 55/2019 has provided a basic framework for the acceleration of electric vehicles, many derivative policies run sectorally without strong synergy between institutions, for example between the Ministry of Transportation, Energy and Mineral Resources, and state-owned electricity providers (PP55, 2019). This disintegration has led to delays in infrastructure standards, charging rates, and the division of investment responsibilities.

In addition, the readiness of digital human resources is an important differentiating factor. The transformation of green mobility requires a workforce with multidisciplinary expertise—combining electrical engineering, data analytics, and green supply chain management. The digital skills gap in several regions, as reflected in the Indonesian Digital Society Index (IMDI 2024), which is still suboptimal, indicates that this transformation process is not yet fully inclusive (Digital, 2024). A lack of digital literacy will limit the integration of EV applications, *smart routing systems*, and predictive maintenance systems, especially in areas with low network infrastructure.

Strategic and Managerial Implications

From a managerial perspective, the main lesson from both case studies is the importance of building *an ecosystem-based strategy* rather than a single corporate strategy. Gojek's success, for example, lies not only in its technological capabilities, but also in its extensive network of partnerships—with TBS Energi Utama, Pertamina, PLN, and local governments—that enable the creation of a shared value system. Similarly, Blue Bird strengthens its competitive position by establishing long-term relationships with BYD and financial institutions to build a more inclusive fleet financing model.

Other transportation companies can emulate this model by putting cross-industry collaboration at the heart of their decarbonization strategy. This includes integrating green energy, logistics, and finance digital platforms to create an efficient and sustainable system.

For policymakers, these findings provide two important implications. First, there needs to be a harmonization of fiscal and non-fiscal policies that support the economies of scale of EVs—including conversion subsidies, renewable energy incentives for SPKLU, and technology interoperability standards. Second, a place-based policy approach is needed that adjusts incentives and infrastructure to regional conditions. This approach is more adaptive than uniform national policies, because it takes into account variations in digital readiness, urbanization levels, and energy capacity between regions.

Theoretically, the integration of digitalization in Indonesia's decarbonization strategy expands the *Triple Bottom Line (TBL) framework* in a more dynamic direction: *profit* is not just a result of efficiency, *the planet* is not just a moral goal, and *people* now encompass the digital dimension that determines participation in the green economy.

Toward a Digital-Driven Green Mobility Transition

This discussion shows that the decarbonization of Indonesia's transportation sector cannot be effective without a strong digital foundation. The green transformation is now shifting from a macro policy agenda to a micro-operational agenda—where the day-to-day decisions of drivers, users and platform-based service providers determine the direction of national sustainability. Digitalization allows every entity, from startups to state-owned enterprises, to contribute to emission reductions through interconnected and measurable systems.

More than just technology, digitalization also functions as a *social infrastructure* that shapes consumer behavior, preferences, and values. By building awareness through digital campaigns, companies such as Gojek and Blue Bird are playing the role not only of transport providers, but also of agents of social change towards a low-carbon lifestyle.

Thus, the future of *zero-carbon mobility* in Indonesia is highly dependent on the collective ability of governments, corporations, and communities to harness the potential of digital as a catalyst for the green transition. The combination of technological innovation, adaptive policies, and cross-sector collaboration will determine whether the vision of *net-zero emissions 2060* can be translated into a reality that is firmly rooted in Indonesia's roads.

CONCLUSION

Digital transformation has evolved from just an operational tool to a strategic foundation in accelerating the transition to zero-carbon mobility. Empirical experience from industry players such as Gojek, Blue Bird, and TransJakarta shows that digitalization is not only an instrument of efficiency, but also a catalyst for structural change that connects the dimensions of technology, markets, and social value. The application of route optimization algorithm systems, real-time telematics, and predictive maintenance has been proven to reduce energy consumption and carbon emissions while increasing operational transparency and corporate competitiveness. Through digitalization, companies are able to integrate technical efficiency with the legitimacy of

sustainability, strengthening the green reputation in the eyes of consumers who are increasingly concerned about the environmental footprint.

More than just technology modernization, digitalization has changed the transportation management paradigm to be more adaptive and data-driven. The digital platform allows companies to dynamically monitor and adjust their operational strategies, from battery maintenance, route optimization, to energy management. Thus, digital technology serves as a bridge between the goal of decarbonization and the logistics reality on the ground, making the sustainability process not only idealistic, but also measurable and replicable. In addition, a new dimension has emerged in the form of green branding and digital trust, where transparency of emission data and the company's green performance are differentiating factors in industry competition.

However, the transformation towards a low-carbon mobility system still faces a number of obstacles. Inequality in charging infrastructure (SPKLU), high initial investment costs, and digital literacy gap between urban and non-urban areas are real challenges. Limited inter-agency coordination and suboptimal fiscal policy harmonization have also slowed down the scale of the implementation of electric vehicles and digital transportation systems. Therefore, the success of this transition requires synergy between three main layers: the physical layer (energy and transportation infrastructure), the digital layer (data, platforms, and analytics), and the human layer (HR and digital culture). When these three dimensions are aligned, the vision of Net Zero Mobility can move from mere policy commitment to inclusive and sustainable realization.

Conceptually, this study emphasizes that digital sustainability in the transportation sector cannot be separated from the social and institutional dimensions. Digitalization will only be effective if it is supported by collaborative governance that connects public, private, and user actors. Technological innovation needs to be accompanied by regulatory updates and financing models that encourage the diffusion of green technology evenly, especially through blended finance schemes, fiscal incentives, and data-driven public investment. Thus, a low-carbon mobility strategy is not only a technological issue, but an ecosystem transformation that requires cross-sectoral coordination.

Future research directions need to be focused on three main domains. First, quantitative analysis of the contribution of digitalization to reducing carbon emissions using big data analytics and life cycle assessment (LCA) approaches so that the value of carbon reduction from digital technology can be measured empirically. Second, the study of digital transportation user behavior needs to be expanded to understand the psychological, social, and economic factors that affect the adoption of electric vehicles and green mobility services. Third, it is necessary to explore a carbon-neutral ecosystem business model that integrates the energy, transportation, and green finance sectors through concepts such as battery-as-a-service (BaaS), digital carbon credits, and renewable energy certificates.

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