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Leveraging Artificial Intelligence for Green Supply Chain Management: Evidence from Viettel Post

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Abstract

This study examines how artificial intelligence (AI) supports green supply chain management practices and why its adoption varies across practice areas in emerging-market logistics. An exploratory single-case study of Viettel Post in Vietnam draws on five semi-structured managerial interviews conducted between July and September 2024, triangulated with company documents and public secondary sources. Thematic analysis is informed by the Technology-Organization-Environment framework and dynamic capabilities theory. Findings indicate that AI-related initiatives concentrate on routing, sorting, reusable packaging collection, and pilot energy controls, where internal data are accessible and operational payoffs are clearer. No AI deployment was reported in green purchasing or inter-organizational environmental collaboration, reflecting constraints in investment, expertise, partner data availability, interoperability, and shared governance. Reported benefits include improved planning, fewer handling errors, and reduced avoidable resource use, although environmental outcomes were not independently measured. The study proposes a five-step roadmap linking internal environmental management, integrated data infrastructure, operational AI applications, reverse logistics, and collaboration supported by data governance. It contributes qualitative evidence on uneven AI adoption and suggests that extending AI-enabled green practices beyond internal operations requires cumulative capability development and partner readiness. Findings provide analytical insights for comparable logistics settings, subject to the limitations of a single case.

Keywords: Artificial intelligence; green supply chain management; logistics; emerging markets; Viettel Post; case study.

1. Introduction

Sustainability is becoming an urgent requirement forcing organizations to reconsider their supply chain operations to minimize their negative impact on the environment. Green Supply Chain Management (GSCM) was born as an approach that integrates environmentally friendly measures into all aspects of the supply chain [1, 2]. GSCM's goal is to minimize environmental impact while improving economic efficiency, through the use of friendly raw materials, energy-efficient processes, and sustainable waste management [1]. Numerous empirical studies have proven that the practice of GSCM benefits operational performance and competitive advantage. For instance, Khan *et al.* (2018) [3] found that high levels of GSCM were positively correlated with corporate financial performance. In particular, in the context of Industry 4.0, digital technologies are expected to be the driving force for GSCM to be more effective. Umar *et al.* (2022) [4] have verified and affirmed that Industry 4.0 technology has a positive impact on the application of GSCM, thereby indirectly improving both economic efficiency and environmental efficiency.

Artificial intelligence (AI) has become a core set of Industry 4.0 technologies that can enhance forecasting, planning, and decision-making in supply chains [5]. Recent review studies argue that AI can contribute to sustainability by improving resource efficiency and enabling better operational control; however, empirical evidence from real organizational deployments remains uneven and context-dependent [6, 7]. In logistics, AI is most frequently applied to routing, sorting, and capacity utilization. These applications may reduce unnecessary mileage, fuel use, and rework, and thus support environmental objectives, but the magnitude of impact depends on baseline processes and measurement practices.

However, applying AI to supply chain management in general, and to green supply chain management in particular, remains challenging in emerging markets. Adoption of digital technologies such as AI or blockchain can be slower than expected due to constraints in infrastructure, skills, investment capacity, and policy support [8]. In Vietnam, the logistics sector is dominated by small and medium-sized enterprises and digital transformation is still uneven [9]. Although many Vietnamese logistics firms recognize the importance of data and analytics (including Big Data and AI) for decision-making [10], implementation is often constrained by high upfront costs, limited expert capacity, fragmented data, and cautious attitudes toward new technologies [11]. These realities call for a staged adoption approach and supportive institutional

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conditions to accelerate both digital transformation and green logistics [8, 11].

Against this backdrop, we conduct an exploratory case study of Viettel Post, a leading logistics enterprise in Vietnam, to examine how AI is applied across green supply chain management practices (GSCMP). We selected Viettel Post because of its scale, visible investments in digital transformation (e.g., automation, IoT, and AI), and its stated sustainability orientation. The study addresses three questions: (1) How is AI currently applied across key GSCMP components at Viettel Post? (2) What benefits are perceived and what barriers constrain wider deployment? (3) What phased roadmap can be derived for logistics firms in similar emerging-market contexts? Our contributions are (i) qualitative evidence on AI-enabled GSCMP in an under-researched emerging economy, (ii) an explanation of uneven adoption using Technology-Organization-Environment (TOE) and dynamic capabilities, and (iii) a practice-oriented roadmap that emphasizes data readiness, governance, and capability building.

2. Literature Review and Theoretical Framework

2.1. Literature Review

GSCMP refer to organizational and inter-organizational actions that integrate environmental considerations into sourcing, operations, distribution, and recovery [1, 2]. Common practice dimensions include internal environmental management (IEM), green purchasing (GP), green operations (GO), reverse logistics (RL), and environmental collaboration (EC) with supply chain partners [1, 12]. Prior studies generally report associations between GSCMP adoption and improved operational and financial performance, although outcomes depend on context, measurement, and organizational capability [3, 10]. In emerging economies, GSCMP uptake varies widely due to differences in resources, leadership commitment, and institutional pressures [10].

Application of AI in supply chain management

AI in supply chain management refers to the use of computational methods (e.g., machine learning, optimization, and advanced analytics) to support forecasting, planning, and decision-making tasks that traditionally relied on human judgment [5]. With increasing data availability from enterprise systems and IoT sensors, AI can enable predictive and prescriptive insights across demand planning, inventory, transportation, and facility operations. Recent empirical reviews emphasize that realized benefits depend not only on algorithms, but also on data quality, system integration, governance, and organizational readiness [7].

In logistics, AI is widely applied for routing and dispatching, warehouse automation, and asset utilization. Empirical research reviews identify transportation optimization and warehouse operations as prominent AI application areas, with potential sustainability co-benefits through reduced empty mileage and better resource utilization [5, 7]. Predictive maintenance is another established use case that combines equipment sensor data with machine learning models to anticipate failures and reduce downtime [13].

AI in green supply chain management practices

The emergence of AI introduces new tools to address environmental challenges across the supply chain. Recent reviews suggest that AI-integrated technologies can support sustainable supply chain management by improving forecast accuracy, enabling more efficient planning, and supporting monitoring and control of resource use [6, 14]. AI-enabled analytics can help reduce waste through better demand-supply alignment, and can support RL and recycling planning by improving visibility over returns and material flows [15]. When combined with sensing and data platforms, AI can also support environmental performance monitoring (e.g., energy use, emissions proxies) and provide timely alerts for corrective actions [14].

Despite this potential, applying AI to GSCMP is challenging due to technical, organizational, and inter-organizational barriers. AI requires reliable and well-structured data, while in many firms environmental and operational data remain fragmented, inconsistently defined, or not digitized [7]. In addition, limited transparency and explainability of some AI models can undermine managerial trust, and cross-firm AI solutions often face data-sharing, interoperability, and governance constraints across supply chain partners [7, 16]. Especially in emerging markets, resource constraints, including finance, skills, and expert availability, can further slow down adoption [8, 11]. Therefore, an effective approach is often staged: firms start from feasible, data-rich applications and gradually expand as data infrastructure, governance, and collaboration readiness improve [6, 7].

2.2. Theoretical Framework: Technology-Organization - Environment and Dynamic Capabilities

To interpret the case evidence, we combine the TOE framework [17] with dynamic capabilities theory [18]. The TOE framework explains technology adoption as a function of (i) technological readiness, such as data availability, infrastructure, compatibility, and perceived complexity; (ii) organizational readiness, such as leadership commitment, skills, resources, and governance; and (iii) environmental conditions, such as regulation, customer and partner pressure, competitive dynamics, and ecosystem readiness. Dynamic capabilities, including sensing, seizing, and transforming, explain how a firm builds and reconfigures resources over time to deploy AI for sustainability-oriented practices [18]. Together, these lenses help explain why AI deployment can be uneven across GSCMP components and how capability building supports a staged roadmap for AI-enabled green logistics.

3. Research Methods

3.1. Research Design and Case Selection

We employed an exploratory single-case study design to investigate how and why AI is applied to GSCMP in a real organizational setting. Case study research is appropriate for addressing "how" and "why" questions about complex phenomena embedded in context [18]. Viettel Post was selected as an information-rich case because it is one of Vietnam's largest logistics providers, has made visible investments in digital transformation (automation, data platforms, and AI-enabled systems), and publicly communicates sustainability-related initiatives. The case boundary covers AI-enabled initiatives related to five widely used GSCMP dimensions: internal environmental management, GP, GO, RL, and EC.

3.2. Data Collection

Interviews

Primary data were collected through five semi-structured in-depth interviews with managerial informants at Viettel Post who were directly involved in, or closely knowledgeable about, digital transformation/AI initiatives and/or green supply chain activities. We used purposive key-informant sampling to ensure functional coverage across major domains, including senior management, operations/logistics, technology/AI, procurement, and environmental/sustainability-related roles. To protect confidentiality, we report informants using anonymized codes rather than job titles. Manager A denotes the senior-management informant, Manager B the logistics-management informant, Manager C the technology-management informant, Manager D the purchasing-management informant, and Manager E the environmental-management informant, as summarized in Table 1.

Interviews were conducted between July and September 2024 and lasted approximately 90–120 minutes each. The interview guide was designed to elicit concrete descriptions of (i) existing GSCMP, (ii) motivations and barriers for implementation, (iii) specific AI-related applications, where applicable, linked to each GSCMP dimension, and (iv) perceived outcomes and challenges. Questions were open-ended to encourage detailed accounts and covered informant roles, AI tools, data sources, environmental indicators, perceived benefits, adoption barriers, partner participation, and planned next steps. With participants' consent, interviews were audio-recorded and transcribed for analysis.

Secondary sources

To triangulate and contextualize interview accounts, we additionally reviewed organizational and public secondary sources, including annual reports, sustainability-related communications, press releases, and credible industry news and conference materials related to Viettel Post's digital transformation and logistics infrastructure [20, 21]. Secondary sources were used to corroborate factual descriptions, such as initiatives announced and facilities described, and to provide context, not to claim causal impact estimates.

Table 1. Description of the managers interviewed

Interviewee & Experience	Field
A - 10 years	Senior Management
B - 8 years	Logistics Management
C - 5 years	Technology Management
D - 9 years	Purchasing Management
E - 6 years	Environmental Management

3.3. Data Analysis

Interview audio was transcribed and the transcripts were analyzed using thematic analysis. We followed an iterative process of familiarization, initial coding, theme development, review/refinement, and final interpretation (Braun and Clarke, 2006) [22]. Coding combined inductive elements (to capture AI applications, enablers, and barriers as reported by participants) with a deductive organizing structure aligned to the five GSCMP dimensions and the TOE and dynamic capabilities lenses.

To strengthen analytical rigor, coding and theme definitions were discussed within the author team and refined through multiple iterations. We maintained a simple audit trail, including coding notes, evolving theme definitions, and links between themes and illustrative excerpts, to support dependability and transparency. The coding structure grouped evidence into five themes: operational optimization, smart internal environmental controls, capability and resource enablers, data/infrastructure readiness, and ecosystem/institutional conditions. These themes were mapped to the GSCMP dimensions, the TOE contexts, and dynamic capabilities. Given the small sample size, we treat findings as exploratory and emphasize analytical generalization, meaning theoretical insight, rather than statistical generalization [19].

We monitored code and theme emergence across interviews to assess whether additional interviews were producing substantially new insights. After the fifth interview, few new codes emerged for core operational and reverse-logistics applications; however, GP and inter-organizational collaboration themes remained less detailed. Accordingly, we interpret these two areas cautiously and explicitly reflect this in the limitations section.

3.4. Trustworthiness and Ethics

We followed established criteria for trustworthiness in qualitative research, including credibility, transferability, dependability, and confirmability [23]. Credibility was supported through data triangulation,

including interviews and secondary sources, and iterative review of themes within the research team. Transferability was supported by providing rich contextual description of the case setting. Dependability and confirmability were supported through documentation of interview procedures and an audit trail of coding and theme refinement. Reporting was guided by the consolidated criteria for reporting qualitative research (COREQ) where applicable to interviews [24].

Ethics and confidentiality

Participation was voluntary and based on informed consent. Interviews focused on professional practices rather than personal sensitive information. To reduce risk of identification, we anonymized informants (Manager A-E), avoided reporting specific job titles, and present results in aggregated form. Audio files and transcripts were stored securely and were accessible only to the research team.

This study involved minimal-risk interviews with adult professionals about organizational practices and did not collect sensitive personal data; therefore, formal ethics committee approval was not required under applicable institutional guidelines. Nevertheless, all participants provided informed consent, and data were anonymized and stored securely.

Fig. 1 summarizes the research process.



Fig. 1. Research Process

4. Results: Viettel Post Case

4.1. Overview of Viettel Post and Green Supply Chain Orientation

Viettel Post is a member company of Viettel Group, mainly operating in express delivery, logistics, and e-commerce. Established in 1997, Viettel Post has built a wide network across 63 provinces and cities in Vietnam and expanded its services internationally. Drawing on telecommunications infrastructure from the parent group, Viettel Post has recently stood out for its strong digital transformation strategy and investment in modern technology. The company has developed digital platforms such as the ride-hailing/delivery application MyGo, the e-commerce platform Voso.vn, and automation solutions at logistics centers, including sorting robots and smart warehouses. Viettel Post positions itself as a technology-oriented logistics enterprise while pursuing sustainable and environmentally friendly development. This orientation is reflected in initiatives to green the supply chain, from internal operations to cooperation with external partners. Below, we compile GSCMPs at Viettel Post using interview and documentary data and then analyze how AI is applied in these green activities.

Overall, Viettel Post has implemented GSCMPs across both internal operations and external collaboration. Manager B, the anonymized logistics-management informant, emphasized that the motivation for green initiatives is not only regulatory compliance but also the recognition that reducing emissions can reduce costs, especially fuel costs. In addition, leadership commitment and a corporate culture that promotes creativity and sustainable development have created a favorable foundation for Viettel Post to test technology solutions serving green objectives. Table 2 summarizes the main GSCMPs at Viettel Post.

For clarity, the abbreviations used below are IEM, GP, GO, RL, and EC.

Table 2. GSCM Practices at Viettel Post

GSCMP dimension	Description at Viettel Post
IEM	- Management commitment, ISO 14001. - Dedicated environmental team. - Training on waste sorting, energy saving, green office spaces.
GP	- Low-emission, fuel-efficient vehicles. - Supplier selection based on eco-criteria and green compliance.
GO	- Replace diesel forklifts with electric. - Save electricity (off-peak shutdowns). - Lean production to cut waste and energy use.
RL	- Reusable packaging (~200 times). - Better returns handling: restock or recycle. - Closed-loop with clients for defective product recovery.
EC	- Expert advice on emission reduction. - Share emission data with partners. - Green delivery options, customer awareness.

4.2. Application of AI in Green Supply Chain Management Practices at Viettel Post

Viettel Post is a prominent enterprise in Vietnam's logistics industry in terms of advanced technology adoption, especially automation and AI solutions for logistics-network optimization. According to internal company documents, the 2015–2020 period focused on digitizing operations and building databases, while from

2021 onward the company began applying AI to strengthen analytical and automated decision-making capabilities. The following subsections present typical AI applications and explain their contributions to each GSCMP dimension.

Internal Environmental Management

The interviews show that Viettel Post pays special attention to internal environmental management as the foundation for a green supply chain. The enterprise builds an internal green culture through employee training, internal policies, and a dedicated environmental department. Manager A, the anonymized senior-management informant, emphasized strong leadership commitment, a sustainability-oriented company culture, and the allocation of resources for environmental activities. These internal platforms create favorable conditions for Viettel Post to implement GSCM effectively and sustainably. Manager B, the logistics-management informant, also highlighted the dual benefit of green initiatives: reducing emissions can simultaneously reduce costs, especially fuel costs.

Regarding AI in internal environmental management, interviewees described early-stage smart energy controls in offices and facilities. Viettel Post uses sensor-enabled control to turn lighting on/off based on occupancy; Manager C noted "automatic turn-off of lights when no one is present" to reduce unnecessary electricity use. The company is also piloting control algorithms for air-conditioning and lighting based on environmental sensor data. While deployment remains limited to selected buildings, these initiatives illustrate how AI-integrated controls can support internal resource-efficiency monitoring and reduce avoidable consumption.

Green purchasing

Viettel Post applies a set of "green" criteria in procurement and supplier-related decisions. For example, the company prioritizes transportation assets that meet emission standards (e.g., electric vehicles, Euro 4 or higher) and screens suppliers and materials using environmental criteria (e.g., compliance with relevant standards and preference for environmentally friendly packaging). These practices extend environmental responsibility upstream into procurement and supplier management.

However, managers reported that AI solutions have not yet been implemented for procurement or supplier environmental evaluation. Current green purchasing decisions largely rely on manual criteria and professional judgment. Interviewees pointed to resource and capability constraints, including "lack of experts and high investment costs" (Manager D). This indicates significant potential for future AI use (e.g., analytics for supplier evaluation and environmental compliance), but also highlights the need for data governance and cross-firm data availability.

The gap between AI potential and green purchasing at Viettel Post reflects a broader challenge: procurement-related sustainability analytics often depends on external supply chain data (e.g., supplier environmental performance, certificates, and life-cycle information) that may be difficult to obtain, standardize, or verify without partner cooperation and shared data infrastructure. This makes green purchasing a comparatively less digitized and harder-to-automate area of GSCMP, especially in emerging-market settings.

Green operations

Although Viettel Post is a logistics company rather than a manufacturing firm, it implements green operational practices analogous to "green production" in industrial settings. Examples include replacing diesel forklifts with electric forklifts at sorting centers, switching off machinery lines during off-peak hours to save electricity, and continuously improving processes to reduce energy, water, and waste. The company also applies lean/5S principles to reduce operational waste. These initiatives illustrate efforts to "green" day-to-day operations and facilities management.

Interviewees described AI-enabled automation in sorting centers (e.g., AGV/robotic sorting) that can increase throughput and reduce handling errors; for example, Manager C emphasized that automation helps to "speed up cargo handling, minimize errors". Such improvements can potentially reduce rework and avoidable energy use. Some public conference and media sources also report automation investments and claimed productivity gains [20]; however, since our study does not have access to audited baselines and measurement protocols, we treat such figures as indicative rather than as causal impact estimates attributable solely to AI. Interviewees also described efforts toward route and load optimization (e.g., reducing empty runs) and the use of AI-enabled dispatching within digital platforms (e.g., MyGo) to shorten delivery distances. These operational applications are comparatively data-rich and align with short-term efficiency priorities.

Overall, Viettel Post's current greening efforts emphasize equipment and process improvements, while AI-enabled green operations are still at an early stage. Interviewees described a pragmatic strategy of prioritizing "low-hanging fruit" applications with clear operational data and near-term payoffs (e.g., routing, sorting, and energy controls) before expanding to more complex, cross-functional or cross-firm initiatives (e.g., predictive maintenance at scale and inter-organizational coordination).

Reverse logistics

Reverse logistics includes recovery of packaging and returned goods, as well as reuse and recycling activities. Viettel Post has introduced reusable packaging solutions since 2022, including durable reusable bags and

circulating plastic containers between centers. Interviewees reported that these items are designed for multiple reuse cycles (in some cases around 200 uses), aiming to reduce packaging waste and long-term costs. The company has also developed processes for handling returned goods (e.g., refurbishment for recoverable items and transfer to recycling partners for damaged goods), supporting a more closed-loop flow compared with a purely linear model.

Interviewees also described early AI use in reverse logistics, particularly for route optimization when collecting reusable packaging. Manager E, the anonymized environmental-management informant, explained that AI-supported route planning can combine regular parcel delivery with the collection of returned reusable bags and containers from post offices and hubs. This integrated routing can potentially reduce collection mileage and associated fuel use compared with manual scheduling. Some informants also mentioned small-scale pilots for more automated sorting or classification of returned materials. Because the study does not have access to audited reverse-logistics performance baselines, we report these impacts as perceived and indicative rather than as quantified causal effects.

In summary, Viettel Post's reverse logistics efforts combine reusable packaging initiatives with early-stage AI-supported planning, illustrating how digital tools may complement circular practices in logistics.

Environmental collaboration

Managers emphasized that collaboration with suppliers, customers, and other logistics partners is important to extend green initiatives beyond internal operations. Interviewees described collaboration activities such as engaging external experts, working with suppliers on greener packaging design and reverse-logistics coordination, and communicating green service options to customers. Manager B noted that the company can improve its internal environment, but broader supply-chain efficiency requires coordination from suppliers and customers. This aligns with prior research that inter-organizational collaboration is a key enabler of broader GSCM outcomes [16].

However, interviewees reported that AI-enabled tools for inter-organizational EC are not yet in place at Viettel Post. Informants, including Managers A, C, and E, stated that the company has not deployed a shared AI-based platform with partners to jointly analyze data or make coordinated decisions for environmental goals. Data exchange remains limited and often relies on ad hoc reporting rather than real-time, standardized data sharing. This reflects common constraints for cross-firm AI deployment, including interoperability, data governance, and trust barriers across supply chain partners [7, 16]. At the same time, interviewees viewed collaboration readiness as a precondition for more advanced AI-enabled green initiatives, suggesting a clear future opportunity once governance and data-sharing mechanisms mature.

Table 3. AI applications in GSCM practices at Viettel Post

GSCMP dimension	AI-enabled applications (current / potential)	Perceived benefits and implementation gaps
IEM	Current: sensor-enabled smart energy controls in offices/facilities; pilot control algorithms. Potential: broader facility energy optimization.	Perceived benefits: reduced unnecessary electricity use; better monitoring. Evidence: interviews (Manager C).
GP	Current: none reported. Potential: analytics for supplier environmental evaluation; document review support (e.g., certificates); forecasting for sustainable sourcing.	Gap: limited data availability, skills, and investment capacity; partner data needed. Evidence: interviews (Manager D).
GO	Current: automation/robotic sorting; AI-enabled dispatching and route/load optimization via digital platforms. Potential: predictive maintenance; deeper network optimization.	Perceived benefits: higher handling efficiency and fewer errors; potential reductions in empty runs and distance. Evidence: interviews + indicative secondary sources [20].
RL	Current: route optimization for collecting reusable packaging; small-scale pilots for automated sorting of returns. Potential: return forecasting and planning.	Perceived benefits: more efficient collection planning; supports reusable packaging loop. Evidence: interviews (Manager E).
EC	Current: none reported. Potential: shared platforms for environmental data exchange, monitoring dashboards, and joint decision support.	Gap: interoperability, governance, and trust barriers limit cross-firm AI deployment. Evidence: interviews + literature alignment [11, 12].

Table 3 summarizes AI-related applications across GSCMP dimensions at Viettel Post and indicates the main types of perceived benefits and implementation gaps identified in the interviews and secondary sources.

Analytical summary

Across the five practice areas, AI adoption is strongest where internal data are available and operational payoffs are immediate (e.g., routing, sorting, and facility energy controls). In contrast, upstream (green purchasing) and cross-firm (EC) areas remain limited because they depend more heavily on partner data, standardization, interoperability, and shared governance mechanisms

5. Discussion

The Viettel Post case broadly aligns with established GSCMP frameworks that distinguish internal practices (e.g., leadership commitment and environmental management systems) and inter-organizational practices (e.g., supplier/customer collaboration and closed-loop initiatives) [1, 12]. The evidence illustrates that both internal and external elements are present: Viettel Post invests in internal environmental management and also engages partners in packaging and reverse-logistics coordination. At the same time, the depth of implementation varies across practice areas, which is expected in emerging-economy contexts where resources and institutional pressures differ across firms and sectors [10].

The case also reinforces prior insights on enabling conditions. Strong internal environmental management - including senior leadership support and an organizational culture oriented toward sustainability - was repeatedly mentioned by informants as a prerequisite for broader GSCMP initiatives. In parallel, managers emphasized that EC with suppliers and customers is necessary to avoid local optimization and to extend green improvements beyond the focal firm, consistent with prior work on inter-organizational integration in sustainable supply chains [16].

AI-enabled GSCMP: perceived benefits and evidence gaps

Viettel Post's AI-related initiatives are concentrated in operationally data-rich areas such as routing/dispatching, sorting automation, and smart energy controls. Interviewees described efficiency-oriented outcomes (e.g., fewer errors, improved planning, reduced unnecessary electricity use) that plausibly support environmental objectives through resource-efficiency mechanisms. These observations are consistent with recent review studies that highlight the potential of AI-integrated technologies to support sustainable supply chain management through better planning and control [6, 7]. However, the current evidence base in this study is qualitative and does not include audited baselines or measurement protocols for environmental performance. Accordingly, we avoid attributing precise quantitative environmental impacts to AI and frame benefits as perceived and indicative.

Implementation gaps and uneven adoption

AI deployment at Viettel Post remains uneven across GSCMP dimensions: green purchasing and inter-organizational EC show limited AI use compared with operations and reverse logistics. The TOE lens helps explain this pattern. Technologically, routing and sorting applications rely on relatively accessible internal data, whereas green purchasing and collaboration depend on external partner data, standardization, and interoperability. Organizationally, interviewees highlighted constraints in expert availability and investment capacity. Environmentally, limited partner readiness for data sharing and governance slows cross-firm solutions. These findings also fit a dynamic capabilities view in which firms build capabilities incrementally: early "sensing" and "seizing" often focus on applications with visible payoffs, while more transformative, ecosystem-level initiatives require stronger governance and collaboration mechanisms [18].

Taken together, the study offers an empirically grounded view of how AI and sustainability intersect in an emerging-market logistics firm. The findings suggest that a staged approach - starting from feasible operational applications and expanding as data readiness and governance mature - may be more realistic than attempting broad AI deployment across all green practices at once. For managers, this highlights the importance of prioritization, data governance, and capability building. For researchers, the case underscores the need for future multi-case and mixed-method studies that combine qualitative process evidence with robust measurement of environmental outcomes.

6. Conclusion

Based on an exploratory single-case study of Viettel Post, this paper provides qualitative evidence of how AI is currently applied across GSCMP in an emerging-market logistics firm. AI use is most visible in operational and reverse-logistics activities (routing/dispatching, sorting automation, and smart energy controls), while AI for green purchasing and inter-organizational EC remains limited. The case suggests that early AI initiatives are motivated primarily by operational efficiency but can also support environmental objectives through resource-efficiency mechanisms (e.g., reduced rework and avoidable energy use).

The study contributes by (i) adding an emerging-economy logistics case to the growing AI-and-sustainable-supply-chain literature, (ii) explaining uneven adoption patterns using TOE and dynamic capabilities, and (iii) offering a phased roadmap that

managers can adapt when data readiness and resources are constrained.

From a theory perspective, the findings are consistent with the TOE framework in highlighting the role of technological readiness (data and infrastructure), organizational readiness (leadership commitment, skills, and governance), and environmental conditions (partner readiness and institutional pressures) in shaping where AI is adopted first [17]. A dynamic capabilities lens further suggests that AI-enabled green practices evolve cumulatively: firms often start by sensing and seizing opportunities in data-rich operational areas, and only later transform processes and partner relationships to enable broader, cross-chain sustainability initiatives [18].

Practical implications

We propose a phased, five-step roadmap for logistics firms to deploy AI in GSCMP under emerging-market constraints (Fig. 2): (1) strengthen internal environmental management and baseline digitization; (2) build an integrated data platform, linking warehouse management system (WMS), transportation management system (TMS), enterprise resource planning (ERP), and IoT data, to reduce fragmentation; (3) deploy AI in operational quick-win areas such as routing, dispatching, sorting, and energy controls; (4) extend AI support to reverse logistics and circular practices, such as packaging recovery and returns planning; and (5) enable inter-organizational collaboration through data governance and secure information-sharing mechanisms.

This roadmap is intended as a practical sequencing logic rather than a one-size-fits-all prescription; firms should adapt the pace and scope based on their data maturity, regulatory context, and partner ecosystem readiness.

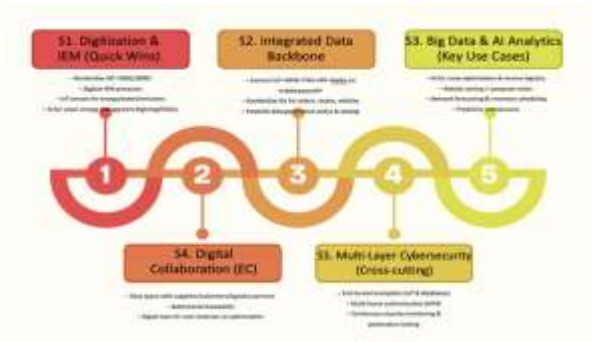


Fig. 2. Proposed 5-step roadmap for applying AI in GSCMP

Policy and ecosystem implications

Supportive institutional conditions can accelerate AI-enabled green logistics, for example through clearer sustainability reporting standards, incentives for low-carbon logistics investments, and guidance on data governance and interoperability for cross-firm collaboration.

Limitations and future research

This study is limited by a single-case design and a small set of managerial interviews, which may reflect organizational narratives and access-related bias. Future research could strengthen evidence by expanding to multiple cases, including non-managerial and partner perspectives, and combining qualitative process analysis with validated environmental performance measures (e.g., fuel use and emission baselines). Cross-country comparisons across emerging-market logistics contexts (e.g., India, Indonesia, Thailand) would also help assess transferability of these patterns.

Overall, the Viettel Post case suggests that AI can support green supply chain practices when deployed with attention to data readiness, governance, and staged capability building in emerging-market logistics contexts.

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