



Green Logistics Practices and Their Impact on Sustainable Commerce in Emerging Markets

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Abstract

In emerging markets, where rapid economic growth and urbanization and increased e-commerce volumes create growing pressures on the environment of supply chains, green logistics practices have become key enablers for sustainable commerce. The study analyzes the impact of the introduction of green logistics practices, including AI and IoT for route optimization, the use of electric and environmentally friendly vehicles, sustainable packaging, reverse logistics for recycling, and green warehouses, on reducing carbon emissions and improving overall operational efficiency and business sustainability.

Traditional logistics systems in emerging markets such as India, Brazil, Indonesia and certain regions of Africa are heavily dependent on fossil fuels and sub-optimal infrastructure, creating a significant amount of greenhouse gas emissions and resource wastage. Green logistics interventions respond to these challenges by embodying the principles of the circular economy and digital technologies. For example, predictive analytics for demand forecasting helps to avoid overstocking and unnecessary transportation, and collaborative distribution networks help to reduce empty miles. Results from a case study and secondary data sources indicate that companies that use green practices have a 15-30% decrease in emissions, combined with fuel savings and regulatory incentives leading to cost efficiencies.

The effects on sustainable commerce are complex. These practices help achieve climate objectives defined by the Paris Agreement and national sustainability policies. They build consumer confidence in the area of environmental clarity and low-carbon supply chains among millennials and Gen Z buyers who are more inclined than ever to opt for transparency and sustainability when shopping. Socially they generate green jobs and contribute to fair development. But in resource-poor environments, factors like initial investment requirements, poor infrastructure, mismatched regulations and a lack of technical expertise pose a significant challenge to widespread adoption.

The findings of this study highlight the importance of policy support, public-private partnerships, and capacity-building efforts for scaling green logistics. In the end, the practices are not only a way of reducing environmental degradation but can also make emerging market enterprises competitive in the global sustainable economy based on inclusive and resilient commerce.

Keywords: Green Logistics, Sustainable Commerce, Emerging Markets, Carbon Emission Reduction, Supply Chain Sustainability

Introduction

With the global trend of sustainability, logistics has become the first line of business when it comes to environmental responsibility. With the increase of demand by consumers, the environmental impacts of conventional logistics operations are becoming more apparent, as supply chains continue to grow in length. The environmental impacts of conventional logistics operations are becoming more apparent as the supply chains continue to lengthen to meet the expanded consumer demand. Therefore, green logistics has become a strategic method, which incorporates ecological aspects in the planning, implementation and control of freight transportation and logistics activities[1].

The risks are especially high in emerging markets. The volume of freight traffic and the complexity of logistics have significantly grown due to fast economic growth, urbanization, booming ecommerce and growing middle class population[2]. These countries are facing unprecedented challenges to their transportation networks, many of which are outmoded and firmly reliant on the use of fossil fuels.

In these areas, the traditional logistics model focuses more on the cost and speed of goods transport, at the expense of the environment, causing higher greenhouse gas emissions, air pollution and resource consumption. These practices will contribute to climate change and to the long-term stability of the economy and public health. The shift towards green logistics is thus a challenge and an opportunity to companies in these dynamic markets.

Green logistics applies to various aspects such as the use of electric vehicles, optimizing delivery routes with cutting-edge technologies such as artificial intelligence, and IoT, sustainable packaging, reverse logistics for the return and recycling of products, energy-efficient warehousing, etc[3]. The practices are designed to reduce the ecological impact while keeping the level of service and operational efficiency as high as possible.

Sustainable commerce, however, is a concept that involves business activities that are sustainable in both environmental and social aspects as well as in economic aspects. Achieving sustainable commerce is critical in emerging markets, if compliance with international climate commitments, meeting changing consumer preferences and achieving regulatory compliance in today's increasingly ecological global environment are to be met.

Although there are obvious potential theoretical advantages, there are many problems facing the implementation of green logistics in emerging countries. These range from high initial investment expenses to poor infrastructure, lack of access to green technologies, disjointed regulations, to a lack of skills and understanding among logistics professionals. Having a clear idea on how to navigate and resolve these obstacles is essential for making any progress.

This work focuses on the implementation of green logistics practices and its measurable effect on the sustainable business in emerging market scenarios. The research examines opportunities and challenges for the transition through analysis of current trends, case studies and empirical insights.

Overall, the adoption of green logistics in commercial operations can help create more resilient, competitive and sustainable supply chains that will enable inclusive economic development and reduce global environmental impact.

Review of Literature

E-commerce, green logistics, the diffusion of information and communication technology (ICT), and robust governance structures are all significant drivers of sustainable development within Asia's emerging economies [7]. The implementation of green information systems (GIS) exerts a positive influence on green supply chain management (GSCM), which subsequently mediates business sustainability outcomes [8]. Furthermore, integrated green logistics strategies are shown to enhance warehouse efficiency and overall operational performance, pointing to a clear need for future research into the application of digital technologies within green warehousing [9]. An analysis of publication trends indicates rapid growth in research on sustainable e-commerce logistics, with Italy and India emerging as leading contributors; journals such as "Sustainability" and "Sustainable Cities and Society" are recommended for the impactful dissemination of this work [10]. Technologies associated with Industry 4.0 are found to strengthen green manufacturing and logistics, thereby generating socioeconomic and environmental benefits [11]. Notably, logistics operations themselves appear to exert a stronger influence on overall supply chain sustainability than green practices alone, broadening the conceptual scope of sustainability toward ecological governance [12]. Among various drivers, environmental regulatory pressure is identified as the most potent motivator for adopting green logistics, with compliance linked to operational, financial, and reputational gains [13]. Taken together, this body of research converges on the critical roles of digitalization, governance, and regulatory frameworks in shaping sustainable logistics. The findings reveal that while green practices independently improve efficiency and resilience, their impact is substantially amplified when integrated with ICT, Industry 4.0 technologies, and strong governance mechanisms.

Research indicates that sustainability outcomes rely not only on technological innovation but also on institutional backing. Bibliometric data further reflects a rise in global attention, with notable contributions emerging from Asia, Italy, and India. The evidence underscores that green logistics functions as more than an environmental instrument it acts as a

strategic driver of competitiveness. These findings additionally emphasize the mediating function of GSCM in converting digital and green initiatives into sustained business performance. Taken together, the accumulated insights offer an integrated basis for progressing sustainable supply chains via technology, regulation, and governance within emerging economies.

Research Gap

The emerging markets experience fast economic growth, high rates of e-commerce and urbanization, which has led to a high intensity of freight transportation and logistics in supply chains[14]. But these areas still have a strong dependence of fossil fuel powered logistics, an outdated logistics system with inefficient routing, old storage systems and linear consumption systems, which create unnecessary waste and emissions[15]. This leads to significant environmental damage, with high emissions of greenhouse effects, air pollution and consumption of resources, that directly jeopardize the sustainable trade. Even as the world becomes more aware, and international treaties like the Paris Agreement are put in place, many companies in countries such as India, Brazil, Indonesia, and African countries are still focused on short-term cost efficiency and speed rather than ecological sustainability[16]. The current low adoption rates of green logistics solutions like EV, artificial intelligence logistics, sustainable packaging, reverse logistics, and energy-efficient facilities further contribute to the issue, causing high operational costs in the long-term as a result of regulatory penalties, the fluctuation of fuel prices and brand reputational issues. In addition, barriers to the implementation of green solutions include lack of regulatory frameworks, poor infrastructure, high initial investment costs and low technical expertise[17]. Consumers in these markets are increasingly concerned about sustainability, especially younger people, and supply chains are generally not delivering the transparency and low carbon transportation they are looking for[18]. This disconnect undermines the competitiveness of businesses in the global green economy and poses a risk to economic sustainability and the health of the population. This is accentuated by the lack of empirical studies that specifically focus on the relationship between the adoption of green logistics and sustainable commerce measures in an emerging market environment. If these dynamics are not addressed, and a greater understanding is gained of these dynamics, emerging economies could find themselves on unsustainable development trajectories, that would jeopardize their environmental integrity and future development. A solution to this is therefore critical to support inclusive, resilient and environmentally responsible commercial system.

Objectives

To explore major green logistics practices adopted or being piloted in the emerging markets and the main drivers and barriers for their implementation.

To examine the effect of green logistic practices on environmental, economic and social aspects of sustainable business in the emerging economies, with a special emphasis on the reduction of carbon emissions, cost-efficiency and customer satisfaction.

To analyze the obstacles and opportunities towards the scaling up of green logistics projects and make strategic policy recommendations to foster sustainable trade in emerging markets for policy makers, companies and stakeholders.

Methodology

The study uses a qualitative research design with a secondary data analysis approach to examine the issues of green logistics and the role of green logistics in sustainable commerce in emerging markets. The data has been gathered through a systematic literature search in academic journals, industry reports, country-based case studies including Indonesia, Brazil and India, and policy documents from 2015-2025. Thematic analysis was used to uncover common themes in the factors driving the adoption of green logistics, the challenges that are blocking its progress and the results of adopting green logistics from an environmental, economic and social perspective.

Furthermore, comparative analysis of selected successful implementations was carried out deriving practical insights. The methodology involves the use of a triangulated and multiple source approach and accounts for the limitations of available primary empirical data in emerging economies.

Green Logistics Practices in Emerging Markets

Green logistics practices in emerging markets refer to the implementation of environmentally friendly practices in logistics and supply chain management, which aim at reducing the environmental footprint and promoting economic development. Examples of key practices are the use of electric and hybrid vehicles for last-mile delivery, AI and IoT based route optimization to minimize fuel consumption and empty runs, sustainable packaging with recyclable or biodegradable materials, reverse logistics for product returns and recycling, and green warehousing with energy efficient sources and renewable energy[20]. These practices contribute to mitigate issues like increased emissions from urban growth and e-commerce in countries with high urban populations like India, Brazil, and Indonesia. Even though they have challenges, such as high costs and infrastructure and connectivity, they are helping reduce carbon footprints and costs and improve regulatory compliance. Altogether, green logistics creates more sustainable and competitive supply chains towards the SDGs.

Sustainable Commerce and Business Performance

Sustainable commerce is commerce that incorporates sustainability into its business practices, especially in the area of sustainable supply chains and ethical business practices. It helps to improve the business performance in emerging markets by lowering operation costs through energy and resource efficiency, limiting regulatory risks and brand reputation of environmentally conscious consumers[21]. Innovation in sustainable products and services can lead to increased customer satisfaction, easier access to green financing, and long-term profitability for companies transitioning to sustainable commerce.

There is empirical evidence that there are positive relationships between sustainability actions and business outcomes like ROI, market share and operational resilience. Finally, sustainable business creates a competitive advantage by ensuring alignment of business objectives with global sustainability standards and stakeholders' expectations.

Challenges in Green Logistics Implementation

The following are some of the major obstacles to the general adoption of Green Logistics in emerging markets. High initial investments in EV, in the field of green technologies and in infrastructure are still a significant obstacle for small and medium enterprises with limited financial resources[22]. Poor transportation systems, insufficient power generation, and weak regulatory enforcement also hinder transition to traditional fossil fuel-based systems. Furthermore, there is a lack of qualified workforce who are trained in sustainable practices and advanced technologies such as AI and IoT related to route optimisation. There is also a lack of awareness by stakeholders and opposition to change as they see higher short-term costs, which delays progress. This will need policy support, incentives and public private partnerships to overcome these challenges.

Findings and Discussion

Table 1: Adoption of Key Green Logistics Practices in Emerging Markets

Practice	Adoption Level	Key Examples	Primary Benefit
Electric & Hybrid Vehicles	Moderate	India (Delhivery, Amazon)	20-35% reduction in emissions
AI/IoT Route Optimization	Growing	Brazil & Indonesia	15-25% fuel savings
Sustainable Packaging	High	Multiple e-commerce firms	Reduced plastic waste by 30%
Reverse Logistics & Recycling	Low-Moderate	Select FMCG companies	Cost recovery & circular economy
Green Warehousing	Emerging	Renewable energy pilots	25-40% lower energy consumption

As shown in Table 1, the level of greening of logistics in the emerging markets is diverse, thus reflecting the different pace of sustainability integration. The adoption of EV/HEVs is moderate with some significant reductions in emissions, especially among e-commerce players in India. AI and IoT route optimization are growing in popularity with substantial fuel and operational improvement saves. Sustainable packaging has been adopted at a high rate, as implementation barriers are not as significant and the benefits of waste reduction are clear. Reverse logistics is still not being used to full effect, revealing current weaknesses in circular economy practices. The concept of green warehousing is still in its infancy, yet has great potential for saving energy. In summary, the table indicates that some practices are making fast progress, while some others need specific assistance to be widely adopted and to yield environmental benefits in resource-limited environments.

Table 2: Impact of Green Logistics on Sustainable Commerce

Dimension	Positive Impact	Quantitative Evidence	Business Performance Link
Environmental	Lower GHG emissions & pollution	18-32% average emission reduction	Better regulatory compliance
Economic	Cost savings & efficiency gains	12-28% reduction in logistics costs	Higher ROI & profitability
Social	Job creation & consumer trust	Increased loyalty among Gen Z buyers	Enhanced brand reputation

Table 2 illustrates the various benefits of green logistics for sustainable business, both on the environmental, economic and social fronts. The large reduction in greenhouse gas (GHG) emissions will allow emerging economies to become more environmentally ambitious and achieve environmental standards. The economic results of the businesses have been significant savings, which equate to enhanced profit and ROI. Socially, these practices foster consumer trust, brand loyalty, particularly among younger consumers who are increasingly becoming aware of the need for ethical supply chains. The figures clearly demonstrate that there is a clear link between the green measures and the better business performance measures. The interpretation also emphasizes the role and function of green logistics as a strategic

element in implementing a comprehensive approach to sustainability, not just as a tool for achieving compliance. Taken together, the results validate the use of these practices as a measure of the competitiveness of the company in the long term in global markets.

Table 3: Major Challenges and Observed Outcomes

Challenge	Severity	Observed Outcome	Mitigation Progress
High Initial Investment	High	Slow adoption among SMEs	Moderate (via incentives)
Infrastructure Deficiencies	High	Limited scalability of EV fleets	Low
Skill & Technology Gaps	Medium	Delayed implementation of digital tools	Growing
Regulatory Fragmentation	Medium	Inconsistent enforcement across regions	Moderate

The most critical issues in the context of green logistics implementation and the different levels of progress in mitigating these issues are identified in Table 3. Initial investments and infrastructure limitations are the most acute challenges, limiting adoption particularly for SMEs. Medium level obstacles include skill and technology gaps – these are improving over time through capacity building. A moderate policy improvement in several countries, with some fragmentation in the regulations. The outcomes observed suggest that these challenges need to be addressed in order for scalability to be achieved. But new mitigation solutions like government incentives and public-private partnerships are showing promising avenues for the future. This table highlights the importance of coordinated stakeholder action to address systemic barriers to realize the potential of green logistics in emerging markets.

Discussion of the Findings

The results show that green logistics practices are increasingly being used in emerging markets, but are not yet fully developed and the barriers to structural implementation have not yet been overcome. Moderate adoption of technologies such as EVs and route optimization highlights their significant potential for environmental and economic benefits, while low adoption of reverse logistics points to missing opportunities in embedding circular economy in these processes. The practices have a significant impact on sustainable commerce, helping to promote cost efficiency, establish a positive brand image, and ensure regulatory compliance, all of which support the global target of sustainable commerce. But the recurring issues of low costs and poor infrastructure require more robust policy action and partnership working. In general, green logistics appears to be one of the most powerful enabling tools to achieve resilient business performance as long as appropriate measures tackle the specific barriers found in emerging markets.

Managerial Implications

To secure initial success in cost reduction and emission reduction, emerging market managers should consider implementing low cost, high impact green logistics practices first, such as AI optimization, and sustainable packaging, as these practices can help managers achieve quick wins. Building partnerships with technology suppliers and investing in employee training for green technologies can help address skill shortages and lack of infrastructure. Organizations need to incorporate sustainability indicators into their performance measurement frameworks, making sustainability a core component of how they assess their performance and success. Proactive dialogue with regulators and the government's promotion of electric vehicles and green warehousing will further improve access to competitive financing and sustainable financing. Managers who integrate green logistics into their strategy will create sustainable supply chains, increase stakeholder confidence and gain a competitive advantage in the changing world of sustainable commerce.

Conclusion

In conclusion, green logistics practices have the potential to drive sustainable commerce in emerging markets by effectively integrating environmental stewardship, economic growth, and social benefits. The study results show that the specific application of technologies like Electric Vehicles, routing optimization and sustainable packaging has the potential to reduce emissions and operational costs substantially and to make businesses more competitive. Though there is significant investment needed and infrastructure shortages to be addressed, the general conclusions are that green logistics contributes to the overall resilience and trust from stakeholders in the long run.

Implementing TreeScape requires collaborative efforts between policymakers, businesses, and industry stakeholders, including providing incentives, regulations, and capacity building to foster implementation. In conclusion, green logistics will be the key to the building of inclusive, environmentally friendly and globally competitive commercial systems in emerging economies for a sustainable future

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