Revue Internationale du Chercheur
ISSN : 2726-5889
Volume 5 : Numéro 2

The Emergence of Sustainable Development Practices: An Overview of Green Logistics in Morocco

The emergence of sustainable development practices: Panorama of green logistics in Morocco

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Date de soumission : 03/03/2024

Date d'acceptation : 06/06/2024

Pour citer cet article :

KASMI M. et al. (2024) : « The emergence of sustainable development practices: Panorame of Sustainable Logistics in Morocco » Revue Internationale du Chercheur « Volume 5 : Numéro 2 » pp : 19 - 46

Résumé

La logistique verte est devenue une composante cruciale de la durabilité dans le secteur des services logistiques. Cette étude s'intéresse à la manière dont les prestataires de services logistiques marocains intègrent les principes de la logistique verte dans leurs opérations, conformément à la charte de la logistique verte. En se fondant sur l'analyse de rapports d'activité et de communiqués de presse, cette recherche explore la portée et l'efficacité des engagements pris par ces entreprises. À travers cette exploration, nous avons évalué les pratiques de logistique verte adoptées et leur impact sur la performance environnementale des prestataires. Les résultats indiquent une adoption croissante des normes de logistique verte, avec des variations significatives en termes de mise en œuvre et d'efficacité. Les implications pour la stratégie d'entreprise et la politique publique sont discutées, soulignant les bénéfices d'un engagement environnemental accru pour les entreprises marocaines et l'économie nationale dans son ensemble.

Mots clés : Logistique durable, logistique verte, secteur logistique marocain, freins à la durabilité

Abstract

Green logistics has become a crucial component of sustainability in the logistics services sector. This study looks at how Moroccan logistics service providers are integrating green logistics principles into their operations, in line with the Green Logistics Charter. Based on an analysis of activity reports and press releases, this research explores the scope and effectiveness of the commitments made by these companies. Through this exploration, we assessed the green logistics practices adopted and their impact on the environmental performance of service providers. The results indicate a growing adoption of green logistics standards, with significant variations in terms of implementation and effectiveness. Implications for corporate strategy and public policy are discussed, highlighting the benefits of increased environmental commitment for Moroccan companies and the national economy as a whole.

Keywords: Sustainable logistics, green logistics, Moroccan logistics sector, obstacles to sustainability

Introduction

At the dawn of the 21st century, global awareness of environmental issues has surged, leading to an increased emphasis on sustainable practices across various sectors. The logistics sector, in particular, emerges as a crucial area for sustainability efforts due to its substantial environmental impact. This is especially pertinent in the context of Morocco, a nation strategically positioned as a gateway between Europe, Africa, and the Middle East, and which is actively modernizing its logistics and transport sectors.

The logistics sector in Morocco has experienced significant evolution, progressively integrating the principles of sustainability. This transformation has been driven by several factors, including government policies, economic reforms, and international agreements. In the 1980s, the use of logistics to address environmental challenges and implement sustainable development principles began to gain traction globally (Hasanspahić et al., 2020). The incorporation of sustainability into logistics has become a central theme, with extensive research underscoring the importance of embedding sustainable policies and strategies into business and industrial operations to safeguard the environment. (Baah et al., 2021). The development of sustainable distribution logistics systems has been a key objective, aiming to effectively integrate sustainable development principles into distribution logistics (Drejeris and Samuolaitis, 2020).

Additionally, the environmental impact of the logistics sector has come under scrutiny, prompting efforts to decouple mobility from adverse effects and reduce carbon dioxide emissions (Savastano et al., 2016). Morocco, in response, has initiated several strategic and policy plans aimed at industrial development and economic growth, such as the National Pact for Industrial Emergence and the Industrial Acceleration Plan (Beladel & Raouf, 2022). These strategies have attracted industrial groups and contributed to the country's specialization in emerging sectors such as aeronautics and automotive.

Morocco's logistical evolution has also been influenced by international agreements and collaborations. The country's geographical position has been leveraged to enhance its international competitiveness, resulting in substantial logistical advancements (El Imrani and Assabane, 2023). Thus, the evolution of the sector has been shaped by government policies, international agreements, and the growing emphasis on sustainable practices, underscoring the country's commitment to addressing environmental challenges and promoting sustainable development.Our introductory research paves the way for a comprehensive analysis of

Morocco's current logistics framework, juxtaposing its practices and challenges in the context

of global sustainability trends and regional economic dynamics. Thus, this article proposes an exploration in order to answer the question: To what extent does the adoption of green logistics practices by logistics service providers in Morocco contribute to the environmental sustainability of the sector, and what are the main challenges and opportunities associated with this transition? We then proceed with a contextualization of the logistics sector, highlighting the specific context of Morocco and the evolution of its logistics sector towards sustainable practices. We will subsequently explore the adoption of green logistics practices in Morocco, assessing their prevalence and environmental impact, and identifying the challenges that must be overcome for effective implementation. Our methodological framework is based on a qualitative analysis of activity reports and press releases, employing a rigorous selection process for the entities studied. Our findings highlight a positive trend towards the adoption of green logistics practices, albeit with variability in their integration and efficiency

1. The emergence of green logistics in Morocco

1.1. Evolution and implementation of the concept: literature review

The concept of green logistics refers to the implementation of environmentally friendly and resource-efficient processes in the management, warehousing, transport and distribution of goods. It encompasses a wide range of practices, from reducing carbon emissions to optimizing resource use, implementing green technologies, and adopting renewable energy sources. Although green initiatives have been encouraged by various actors (Bag, 2017; González-Benito, 2006), few studies have explored in detail how adopting green practices improves a company's environmental reputation and financial performance, particularly in the context of emerging economies and from the perspective of logistics companies. Moreover, the adoption of sustainable standards such as ISO 14001 in 1996 has encouraged the development of corporate sustainability strategies for the preservation of the environment (Fernando, 2017), while legislation and regulatory standards have forced companies to comply with environmental standards to operate without legal sanctions (Baah et al., 2020).

The global importance of sustainable logistics intersects with environmental concerns and economic pressures. It is characterized by environmentally friendly practices and resource efficiency that meet the complex challenges of the logistics industry. Environmental concerns such as climate change and pollution, economic imperatives for profitable operations, and social responsibilities for sustainability principles shape the global importance of sustainable logistics.

Green logistics also represents three perspectives: public (from public to private), operational (from operational to strategic) and local (from local to global). The first perspective of green logistics is with stakeholder groups that have begun to lobby government intervention to mitigate the adverse effects of freight transport and public agencies have sought to improve their understanding of the problem and find ways to address it. The public sector's interest in this topic has been complemented by increasing private sector participation in green logistics research, as companies have started to formulate environmental strategies both at the company level and more specifically for logistics. The second general trend has been the broadening of the company's commitment to green logistics, from adopting a few minor operational changes to integrating environmental principles into strategic planning. The local and global perspective focuses on the local environmental impact of air pollution, vibration, noise, accidents, and visual intrusions. The study conducted by Lin and Ho (2010) indicates that factors such as state legal regulations, government support, organizational backing, and the quality of human resources significantly positively impact the adoption of green practices among Chinese logistics companies. Environmental uncertainty and the complexity of ecological practices have significant negative influences on environmental practices. Surprisingly, the influence of customer pressure is not significant for Chinese logistics companies (Lin and Ho, 2010). This is interesting because most EU studies associated with environmental issues indicate the influence of customer pressure and environmental awareness on environmental practices, but these results focus on manufacturing companies. Their study also provides empirical evidence that technological factors have a significant influence on the adoption of green practices compared to organizational and environmental factors (Lin and Ho, 2010). Similar results come from Polish studies, which indicate a weak and non-significant correlation between environmental awareness among management staff and the eco-efficiency of environmental practices (SerokaStolka, 2014). With climate change now the main environmental issue today, the impact of logistics on global atmospheric conditions has become a major concern for many researchers (McKinnon A., Browne and Whiteing, 2010). Hu and Hsu (2010) explore the factors that are critical to the implementation of green supply chain management (GSCM) practices in Taiwan's electrical and electronics industries with reference to European Union directives, and they extract 20 critical factors in four dimensions (supplier management, product recycling, organizational involvement, and lifecycle management) (Hu and Hsu, 2010). Diabat and Govindan (2011) introduce the review of studies that present different factors in

the management of the green supply chain. Indeed, Diabat and Govindan (2011)

present 11 types of driving forces (and the interactions between them), which have been analyzed using interpretive structural modeling (ISM). The research findings show that government regulations and legislation and reverse logistics are important driving forces in achieving cooperation between product designers and suppliers to reduce and eliminate the environmental impact of products. Environmental cooperation with suppliers and customers and ISO 14001 certification are at an intermediate level of the ISM model. Green design, the integration of quality environmental management into the planning and operation process, the reduction of energy consumption, the reuse and recycling of materials and packaging are at the top of the ISM hierarchy (Diabat and Govindan, 2011). The ISM model of the driving forces affecting the implementation of green supply chain management is composed of:

1. Supplier Environmental Management System Certification
2. Environmental collaboration with suppliers
3. Collaboration between product designers and suppliers to reduce and eliminate the environmental impacts of products
4. Government Regulation and Legislation
5. Green Design
6. ISO 14001 Certification
7. Integration of environmental quality management into planning and operation processes
8. Reduced energy consumption
9. Reuse and recycling of materials and packaging
10. Environmental collaboration with customers
11. Reverse Logistics

1.2. The sustainable performance of the Moroccan context

Morocco, strategically located between Europe and Africa, faces unique challenges and opportunities in this area. Its geographical advantage facilitates trade and logistics, but also presents challenges such as managing the increase in freight traffic with minimal impact on the environment. Economic growth in sectors such as automotive, aerospace, and renewable energy is increasing the demand for sustainable logistics solutions. Environmental concerns, which are at the heart of Morocco's concerns, require a shift towards sustainable practices in logistics, given the sector's contribution to greenhouse gas emissions. Since the push towards sustainable logistics is not only a response to global environmental concerns, but also a

strategic decision to strengthen the country's competitive advantage in the global market. By

adopting sustainable logistics practices, Morocco aims to reduce operational costs, improve efficiency and contribute positively to the environment, aligning its economic growth with environmental preservation.

Aware of the urgency of environmental and social protection while improving its economic development, Morocco is committed to supporting the action of the international community to meet the climate challenge. It was also during COP 22 that the issue of the environmental sustainability of logistics mobilized Moroccan private and public actors to adhere to the "Moroccan Charter for Green Logistics" in 2016 in order to reduce the impact of greenhouse gas (GHG) emissions generated by logistics activity. This charter commits logistics and transport operators, as well as logistics building builders, to operate in an environmentally friendly manner with photovoltaic panels, rainwater harvesting systems and low-voltage lighting as prerequisites.

Over the past two decades, Morocco has taken a proactive approach to a green and inclusive economy. This commitment was reflected in the adoption in June 2017 of the National Strategy for Sustainable Development (NSSD), a unifying framework for the integration of sustainability into all sectoral policies.

Morocco is ranked 26th in the Green Future Index 2021; ranked first in the MENA region and second in Africa (MIT Technology Review Insights, 2021). The Kingdom ranks 27th in terms of climate policy, 41st in terms of CO2 emissions and green society and 47th on the basis of the energy transition (IDEM).

According to the 2021 Climate Performance Index (CPI), Morocco ranks fourth out of 58 countries assessed, just behind Sweden, Denmark and the United Kingdom (MIT insights 2021).

The NSSD has a satisfactory deployment rate. At the end of May 2021, its overall growth was around 58%, compared to an implementation rate of 43% at the end of 2019. (Court of Auditors 2020):

-On the issue of consolidating the governance of sustainable development, projectsopened in this direction cover 53% of the objectives.

-As part of the challenge of transitioning to a green economy, 72% are currentlycovered.

-The challenge of improving the management and development of natural resourcesand strengthening biodiversity conservation was met by 76%.

On the strength of this success, Morocco has revised its ambitions upwards and has set itself the goal of reducing its greenhouse gas emissions by 45.5% by 2030.

Investments have improved the quality of and access to services. Morocco is the 4th African country with the best roads in 2019 (OECD, 2020). As far as infrastructure is concerned, Morocco is first in Africa in terms of the quality of infrastructure according to the Global Competitiveness Index 2016-2017.

The regulatory framework in Morocco, including initiatives such as the National Charter for Environment and Sustainable Development, supports sustainability but encounters challenges in effective implementation within the logistics sector. Continuous integration of sustainability into infrastructure development, such as ports and transport networks, is crucial. Technological advancements, including the Internet of Things (IoT), artificial intelligence (AI), and blockchain, offer significant potential to enhance the efficiency and sustainability of logistics operations. Additionally, training a skilled and competent workforce in sustainable practices is essential, necessitating education in new technologies and methodologies.

Collaboration between government, industry, academia, and international partners is key to achieving sustainable logistics in Morocco. A culture shift among stakeholders, prioritizing sustainability in decision-making, is also required. As Moroccan companies increasingly integrate into global supply chains, aligning local practices with international sustainability standards becomes ever more important.

However, Morocco's transport sector remains heavily dependent on petroleum-based fuels, such as petrol, natural gas, and diesel, which are converted into CO2 emissions based on the GHG emission factor in the Long Range Energy Alternative Planning (LEAP) model. Internationally, biofuels and natural gas currently play a minor role in meeting road transport needs (Safaai et al., 2010). Despite the claims of green innovations to reduce CO2 emissions and fuel consumption, few logistics service providers (LSPs) have incorporated green innovations into their logistics activities (Aronsson and Brodin, 2006).

2. Green logistics applied in Morocco

Sustainable logistics in Morocco has emerged through various innovative projects and initiatives aimed at promoting green transport, energy efficiency, and waste reduction. According to data available in specialized press and annual activity reports of companies, a remarkable dynamism can be observed in the Moroccan logistics market.

2.1. Methodological framework

Our study employs a qualitative methodology to examine the practices advocated in the adoption of green logistics by Moroccan logistics service providers. This approach enables a detailed exploration of these practices and an assessment of their prevalence through quantitative figures.

The entities selected for analysis adhere to stringent criteria: they must have officially committed to the Moroccan Charter for Green Logistics and operate significantly within Moroccan territory. Additional selection factors include the duration of their commitment, the size of the company, and the public visibility of their green logistics initiatives.

Primary data sources include business reports and press releases issued by companies. Supplementary documents, such as news articles and official publications related to the Green Logistics Charter, were also reviewed to contextualize the data.

A. Identification of Committed Logistics Service Providers:

We conducted a systematic census of service providers adhering to the Moroccan Charter for Green Logistics using industrial databases and professional registers, complemented by targeted media monitoring.

B. Activity Report Collection Procedure:

Annual reports and other institutional communications were filtered based on their relevance to green logistics. NVIVO12 software was utilized to extract information related to green logistics initiatives.

C. Press Release Collection Procedure:

Content analysis was performed using a thematic analysis grid, which enabled the identification of trends and key highlights related to green commitments.

2.2. Analysis of the results

Actions	Percentage of request by the logistics service provider
Digitization of procedures	81%
ISO 9001 Certification	18%
ISO 14001 certification	11%
ISO 26000/CSR certification	32%
Clean Transportation Initiatives	51%
Smart and efficient storage	64%

Waste management	72%

Sustainable cooperation	78%
Awareness and training	43%

- Digitization of procedures

The digitalization of procedures is essential for sustainable logistics, as it facilitates efficient resource management and data-driven decision-making (Wang et al., 2016). By integrating digital technologies such as IoT and AI, logistics companies can optimize routes and reduce emissions, contributing to environmental sustainability (Srivastava, 2007). Digitalization also improves the transparency and traceability of supply chains, which is essential to ensure responsible sourcing and minimize waste (Kache and Seuring, 2017). In addition, digital tools enable real-time monitoring and predictive maintenance, which helps reduce downtime and improve operational efficiency (Ben-Daya et al., 2019). Transport and logistics optimization, which is crucial for operations and customer service, can be achieved via optimization methods such as Nearest Neighbour and Vogel's Approximation (Pečený, 2020). The ASEC methodology, developed to integrate safety and the environment into route optimization, underlines this importance (Faulin, 2011). In urban areas, multimodal routes help reduce congestion and improve efficiency (Bousquet, 2010), while urban logistics represents a key vector for meeting the challenges of sustainable development. Thus, digitalization not only streamlines logistics processes, but also aligns them with the sustainability goals.

- Certifications

Certifications play a crucial role in sustainable logistics practices, serving as both a validation and a roadmap for the implementation of these practices. They provide a standardized framework, ensuring that logistics operations meet established environmental and social responsibility criteria. This standardization is essential for performance benchmarking and continuous improvement (Rao & Holt, 2005). Certifications also build credibility and trust among stakeholders, including customers and partners, who are increasingly demanding measurable sustainable practices. Additionally, they can lead to operational efficiencies and cost savings, while fostering a culture of sustainability within organizations (Villena & Gioia, 2020). In the global marketplace, certifications position companies competitively, aligning them with international best practices and regulatory compliance.

- Green Transportation Initiatives:

- Adoption of electric vehicles in logistics: Morocco is actively promoting the use of electric vehicles (EVs) in logistics to reduce carbon emissions. These include incentivising logistics companies to switch to electric vehicles and developing a supporting infrastructure for electric transport.
- Solar Transportation: 13% of companies have started integrating solar energy into their transportation fleets. This includes installing solar panels on the roofs of trucks and warehouses, which helps reduce reliance on fossil fuels.

- Energy-efficient storage:

In the Moroccan context, the integration of sustainable practices in logistics, particularly through the development of smart and green warehouses, is paramount and offers significant opportunities. Research by Verlinde and Macharis (2016), for example, demonstrates the importance of smart warehouses for sustainable logistics, highlighting how technologies like LED lighting, solar panels, and automated systems align with sustainability goals. These technologies not only reduce energy consumption, but also minimize operational costs in the long run.

Regarding thermal insulation in storage, studies by Jones et al. (2017) highlight the importance of adopting advanced materials and designs for insulation, with a view to energy conservation. This approach is particularly relevant in key sectors of the Moroccan economy, such as agriculture and pharmaceuticals, where temperature control is essential.

To succeed in these initiatives, it is crucial for Morocco to foster an environment that encourages investment in sustainable technologies and to provide training and resources for their deployment. This could include, according to Patel et al. (2020), government incentives for green building practices and public-private partnerships to develop sustainable logistics infrastructure.

- Waste management strategies:

In the Moroccan context, waste management strategies in logistics, such as recycling and reuse of packaging materials, are essential and aligned with the country's sustainability goals. According to studies such as those by McKinnon et al. (2018), recycling and reuse in logistics can significantly reduce the environmental impact. The adoption of biodegradable materials, as highlighted by Sharma et al. (2020), is particularly relevant for reducing plastic pollution. In addition, optimizing logistics routes, a strategy highlighted by Sbihi and Eglese (2010), can

lead to a significant reduction in greenhouse gas emissions. These practices, supported by

advanced technologies, as indicated by Liao et al. (2017), can improve the efficiency and sustainability of the logistics sector in Morocco.

The link between sustainable logistics and waste management is a crucial aspect of environmental sustainability. Fernando (2016) and Starostka-Patyk (2010) both highlight the role of reverse logistics in waste management, with the former emphasizing its potential to improve operational performance and the latter proposing a model for its implementation in industrial waste management. Halldórsson (2019) further explores the role of consumers in waste supply chains, highlighting their potential as co-producers of sustainability. Mohammadi (2018) takes a broader perspective, discussing the design of a sustainable supply chain network for the optimal use of municipal solid waste, considering economic and environmental factors. These studies collectively highlight the importance of sustainable logistics in waste management, with a focus on reverse logistics and consumer involvement. In addition, the establishment of recycling programs for used packaging contributes to the achievement of the country's broader environmental goals, as outlined in initiatives such as the National Charter for the Environment and Sustainable Development. By incorporating these practices, Moroccan logistics companies ensure that they not only reduce their environmental footprint, but also align with global sustainability trends, which is beneficial for their international partnerships and market image.

- Collaboration for sustainability:

In Morocco, partnerships between logistics companies and environmental organizations, as highlighted by Porter and Kramer (2011) in their theory on shared value creation, offer significant potential to promote sustainable practices. These collaborations, according to Hart (1995) in his theory of natural-resource-based view, allow companies to benefit from the expertise of environmental organizations, particularly in the areas of sustainability, environmental impacts and regulatory frameworks. These partnerships, explains Elkington (1997) with his triple bottom line concept, can lead to innovations in sustainability and contribute to both economic development and environmental protection, thus aligning corporate responsibility with the Sustainable Development Goals.

Such partnerships allow logistics service providers to leverage the specialized knowledge and expertise of environmental organizations. These organizations often have a deep understanding of sustainable practices, environmental impacts, and regulatory frameworks. Indeed, by working together, logistics companies can develop more effective and innovative sustainability

strategies that may not be feasible independently.

In addition, these partnerships enhance the reputation of the logistics sector in Morocco, demonstrating a commitment to corporate social responsibility and environmental stewardship. This is especially important as consumers and international business partners increasingly prefer to engage with companies that have strong sustainability credentials.

In addition, these collaborations can support Morocco's national sustainability goals. The country has made significant progress in renewable energy and aims to reduce its greenhouse gas emissions, as outlined in its Nationally Determined Contributions under the Paris Agreement. Logistics companies that work with environmental organizations contribute directly to these national goals.

- Education and training:

Training and awareness-raising are key elements for the development of sustainable logistics. According to the work of Wolf and Seuring (2010), training improves the knowledge and skills needed to implement sustainable logistics practices. In addition, according to Sarkis et al. (2010), awareness fosters an organizational culture that values sustainability, leading to more responsible decisions in logistics operations. Thus, the combination of training and awareness is crucial to transforming logistics practices and aligning activities with the Sustainable Development Goals.

Conclusion

The in-depth analysis of green logistics practices within Moroccan logistics service providers reveals a positive trend towards the adoption of sustainable strategies. While the commitment to the Green Logistics Charter is evident, levels of integration and efficiency vary widely. Companies are demonstrating increased awareness of the economic and environmental benefits associated with green practices, although barriers remain to their full realization. Government initiatives, such as regulation and legislation, as well as international certifications, are emerging as key drivers of this transformation. Nevertheless, for substantial and lasting change, deeper involvement of industry players, increased collaboration with stakeholders and the adoption of international standards are needed. This study contributes to the literature on green logistics by providing a unique insight into practices in Morocco and serves as a starting point for future research to assess the longitudinal impact of these practices on the country's sustainable development.

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