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Urban logistics as a lever for the energy transition: a qualitative analysis of corporate practices in the Casablanca–Settat region

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ABSTRACT: In a global context marked by climate urgency and the need to transform production systems, urban logistics has emerged as a strategic lever to support the energy transition. In Morocco, national decarbonization policies—particularly the National Energy Transition Strategy and the National Sustainable Development Strategy—aim to promote a more resource-efficient logistics system integrating renewable energy, mobility electrification, and flow optimization. However, the actual contribution of urban logistics companies to this transition remains understudied, especially in emerging metropolitan areas such as Casablanca–Settat, the country's main economic hub. This study examines, through a qualitative approach, how urban logistics contributes to the energy transition. It is based on an investigation conducted with three logistics companies operating in the Casablanca–Settat region, in order to analyze how they integrate energy transition principles into their urban operations. Preliminary findings reveal a contrasted dynamic: while some firms are already adopting innovative solutions (solar energy, electric mobility, algorithmic route optimization), others face organizational, financial, and institutional constraints. This research contributes to the literature on sustainable urban logistics and proposes avenues for strengthening the energy transition within Moroccan logistics systems.

Keywords: Urban logistics, Renewable energy, Energy transition, Sustainable mobility, Decarbonization, Morocco.

1. INTRODUCTION

In a global context marked by climate urgency and the need to transform production systems, urban logistics emerges as a key lever for supporting the energy transition (Carbone & Moatti, 2011). Cities, which concentrate the majority of goods flows, are also responsible for a significant share of greenhouse gas emissions from road transport (Dablanc, 2019). Therefore, the implementation of cleaner, more rationalized, and better-integrated logistics solutions within urban policies has become a priority.

In Morocco, this transformation is part of a national strategic framework. The National Energy Transition Strategy (SNTE) and the National Sustainable Development Strategy (SNDD) promote the decarbonization of logistics activities, the integration of renewable energy, the electrification of mobility, and the optimization of flows. However, the actual contribution of urban logistics companies to this transition remains underexplored, even though emerging metropolitan areas such as Casablanca–Settat play a central role in the country's economic dynamics.

This study aims to understand how urban logistics companies integrate the principles of energy transition into their daily operations. Through a qualitative approach conducted with three representative companies

in the sector (parcel delivery, distribution, and logistics service provider), it explores the practices implemented, the innovations adopted, and the obstacles encountered. The scientific contribution of this research lies in the empirical insight it provides into a topic that remains underexplored in the Moroccan context, despite its strategic importance.

2. CONCEPTUAL FRAMEWORK OF THE RESEARCH

In this section, we examine the main concepts related to our research topic in order to avoid any conceptual confusion. We successively address urban logistics, the energy transition applied to logistics, and urban logistics from a sustainability perspective.

2.1. Urban logistics: definitions and challenges

Urban logistics refers to all physical, informational, and organizational flows involved in the distribution of goods in urban areas (Taniguchi & Thompson, 2018). It encompasses delivery operations, collection, intermediate storage, as well as the associated technological and organizational solutions. The main challenges include:

- Reducing pollutant emissions;
- Ensuring smooth flows in dense urban spaces;
- Minimizing operational costs;
- Enhancing service quality for customers.

2.2. Energy transition and logistics

The energy transition refers to the shift from a system based on fossil fuels to a model grounded in renewable energy, energy efficiency, and sobriety (IEA, 2022). In logistics, this is reflected in particular through:

- Fleet electrification;
- The use of renewable energy in platforms and warehouses;
- Algorithmic optimization of routes;
- Flow pooling to reduce the number of trips.

2.3. Sustainable urban logistics

Sustainable urban logistics aims to reconcile operational performance with the reduction of negative externalities (Russo & Comi, 2020). The literature shows that companies are gradually adopting:

- Electric or hybrid vehicles;
- Smart flow management solutions;
- Photovoltaic infrastructure;
- Alternative delivery schemes (urban hubs, cargo bikes, etc.).

However, in emerging countries, adoption remains limited due to institutional constraints, low technological maturity, and the high cost of investments.

3. RESEARCH METHODOLOGY

The study is based on an exploratory qualitative approach, chosen to better understand a phenomenon that remains underexplored in the Moroccan context. This type of approach makes it possible to gain an in-depth understanding of complex organizational dynamics and to access the internal logics guiding companies' decisions regarding the energy transition. It is also particularly suitable for capturing the

perceptions, strategies, and constraints experienced by operational actors—dimensions that are difficult to grasp through quantitative methods.

The sample consists of three logistics companies operating in the Casablanca–Settat region. The first, a parcel delivery company, specializes in last-mile delivery activities, a segment particularly sensitive to environmental and energy-related issues. The second, active in urban distribution, operates in both food and non-food distribution, which involves managing significant daily flows. The third is a third-party logistics provider (3PL) offering integrated services in warehousing, transportation, and flow management. These companies have been anonymized in accordance with research ethics standards in order to preserve the confidentiality of the information shared.

Data collection relied on several complementary techniques. Nine semi-structured interviews were conducted—three per company—with logistics managers, operational staff, and quality or CSR managers. These interviews provided rich insights into current practices, planned initiatives, and the obstacles encountered. Direct observations were also carried out on company sites, including warehouses, vehicle parking areas, and certain delivery operations, in order to identify actual practices and existing infrastructure. Finally, a document analysis was conducted using internal reports, technical sheets, CSR action plans, and operational documents, enabling the triangulation and enrichment of data obtained from interviews and observations.

Data processing was carried out through thematic analysis. The information was first coded and then grouped into four main categories reflecting the key dimensions that emerged from the study:

- The decarbonization of operations;
- Energy innovations implemented or envisioned;
- Constraints hindering the energy transition;
- Development prospects identified by the companies.

This approach made it possible to structure the interpretation of the results while preserving the complexity of the discourses and observed situations.

4. RESULTS

4.1. Adoption of renewable energy

Regarding the adoption of renewable energy, two companies, A and C, have invested in the installation of photovoltaic panels on their warehouses. These installations cover between 20% and 35% of their energy needs and allow not only a significant reduction in electricity costs but also partial autonomy, particularly during peak consumption periods. The managers interviewed also highlighted the positive impact on the company's CSR image, strengthening their position with environmentally conscious clients and partners. In contrast, Company B considers that the return on investment for solar panels is too long given its financial constraints and prefers to focus on other less costly logistics initiatives.

4.2. Electrification of mobility

Electrification of mobility, although identified as a key lever of the energy transition, remains limited. Company A has converted 12% of its fleet to electric vehicles, mainly for short urban trips and last-mile deliveries. Company C is currently testing three vehicles in a pilot phase to evaluate range and maintenance costs. Company B has not yet integrated electric vehicles, citing the high cost of batteries, limited range for long-distance trips, and the absence of public subsidies as major barriers. All three companies acknowledge that these factors, combined with a lack of reliable charging infrastructure, hinder large-scale adoption.

4.3. Algorithmic optimization of routes

All companies use digital solutions to optimize their routes, but the level of sophistication varies. Company A operates a comprehensive intelligent system integrating real-time optimization algorithms and multiple constraints (traffic, delivery time windows, vehicle capacity). Company B uses a simpler solution based on geolocation and manual route optimization, yielding modest but immediate gains. Company C is experimenting with artificial intelligence to dynamically adjust routes, showing promising results in reducing kilometers traveled and improving load factors. Overall, these tools have led to fewer delays, better energy performance, and reduced environmental impact.

4.4. Organizational and institutional constraints

Finally, several organizational and institutional constraints hinder the energy transition. Companies mention the lack of fiscal incentives and public support for acquiring electric vehicles, insufficient charging infrastructure in urban areas, and high investment costs for renewable solutions. In addition, a limited sustainability culture within some teams and the multiplicity of regulations, combined with administrative delays, complicate the implementation of innovative projects.

Table 1. Summary of Results

Transition Axis	Company A	Company B	Company C	Key Benefits / Observations	Main Constraints
Renewable energy	Photovoltaic panels covering 25% of needs	No investment	Photovoltaic panels covering 20–35% of needs	Cost reduction, partial autonomy, improved CSR image	Long ROI for B, high investment costs
Fleet electrification	12% electric vehicles	0%	Pilot phase: 3 vehicles	Reduction of local emissions, improved CSR image	High battery costs, limited range, lack of public support
Route optimization	Advanced intelligent system	Simple geolocation solution	AI experimentation	Reduced distance traveled, improved load factor, fewer delays	Technological complexity, adaptation to local constraints
Organizational & institutional constraints	Lack of fiscal incentives, weak sustainability culture, administrative delays	Same as A	Same as A	—	High investment costs, limited infrastructure, regulatory complexity

Source. Developed by the authors

5. DISCUSSION

The results show that Moroccan companies are engaged in differentiated energy transition pathways. The presence of innovative initiatives confirms the relevance of national policies; however, the transition remains constrained by:

- Weak institutional support;
- Lack of targeted assistance for the logistics sector;
- Financial constraints specific to logistics SMEs.

The literature confirms that emerging countries face similar challenges (Russo & Comi, 2020; Taniguchi & Thompson, 2018). However, our study reveals that Morocco has significant leverage, such as:

- Strong solar potential;

- A growing dynamic of logistics digitalization;
- A clear political commitment since the SNTE.

This opens the way for an accelerated transition if support mechanisms are strengthened.

6. CONCLUSION

This research shows that urban logistics can play a strategic role in the energy transition in Morocco. The companies studied are already adopting innovative solutions, such as the installation of photovoltaic panels, partial electrification of fleets, and algorithmic optimization of routes, enabling them to reduce energy costs, CO_2 emissions, and improve their CSR image. These initiatives demonstrate the potential of private actors to contribute to the sustainability of urban logistics systems.

However, the large-scale deployment of these practices remains limited by financial, institutional, and organizational constraints. High investment costs, insufficient public support and charging infrastructure, as well as a limited sustainability culture and regulatory complexity, hinder the widespread adoption of sustainable energy solutions. These obstacles highlight the need for more structured support to promote the energy transition in the logistics sector.

To overcome these limitations, the study proposes three main courses of action: introducing financial or fiscal incentives for the acquisition of electric vehicles, developing public charging infrastructure in logistics zones, and strengthening technological support through digitalization and the integration of optimization and artificial intelligence tools. These combined measures could help create a more sustainable logistics ecosystem, contributing to the decarbonization of urban operations while enhancing the competitiveness and resilience of companies.

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