


# Chapter 4

# Green Technologies and Sustainable Transport Towards Ecological Logistics

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## **ABSTRACT**

*This work delves into the intersection of sustainability and logistics, beginning with a case study on Tunis, which highlights the challenges of congestion and emissions in urban freight transport. The study quantifies road freight emissions in Tunis, providing valuable insights into their environmental impact and the urgent need for sustainable alternatives. The chapter then transitions to exploring innovations in sustainable transportation, including electric vehicles, drones, and emerging technologies like intelligent transportation systems (ITS). These innovations are reshaping urban logistics, offering pathways to reduce emissions and enhance efficiency. Further, the chapter examines strategies for reducing the carbon footprint in logistics, such as route optimization, the use of biofuels and renewable energies, and reverse logistics practices. These approaches demonstrate how companies can minimize their environmental impact while maintaining operational effectiveness.*

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## INTRODUCTION

As global concerns over climate change and environmental sustainability intensify, the logistics and supply chain sectors face increasing pressure to reduce their carbon footprint and adopt greener practices. Indeed, traffic congestion is a growing problem in Tunisia. This problem is becoming critical in our major cities, where daily commute times are reaching unprecedented levels that compare unfavorably with those observed in some foreign cities of equivalent size. This problem is also growing in medium-sized cities. As a result, it reduces the quality of life of Tunisians, wastes energy, and produces greenhouse gases and other pollutants that are harmful to Tunisia's environment. But above all, congestion generates significant economic costs. Investment and employment decisions depend on the quality of transportation infrastructure and the free movement of goods and people within and across our cities. Congestion increases current costs and discourages future investment. The effects of congestion are apparent, but its causes are complex. Fundamentally, congestion results from the overuse of a scarce, low-cost resource: road space. In its simplest form, congestion appears to result from insufficient investment in road and transit capacity. But this explanation underestimates the many factors that determine why and how people travel. A multitude of factors, including changes in the economy and employment, demographics, land use, and housing costs, influence congestion levels.

The goal is therefore not to reduce mobility, but to organize it in such a way that it does not cause negative externalities. Indeed, everyone has become aware of the need to seek adequate remedies for these ills and find relevant solutions to develop an efficient, sustainable, and high-quality transport system for their cities and citizens. With an eye on road traffic issues (particularly its automobile component, which remains a major source of controversy), road congestion is a major concern in terms of transport sustainability (Akhtar & Moridpour, 2021 ; Xu et al., 2024). Nowadays, it is primordial to explore innovative solutions and strategies to achieve these goals, focusing on the integration of advanced technologies and renewable energy sources into supply chain operations.

Road freight transport accounts for approximately 30% of total transport emissions (ITF, 2023). In Europe, it contributes approximately 5% of CO<sub>2</sub> emissions (EEA, 2022). Notably urban freight transport accounts for 10 to 20% of CO<sub>2</sub> emissions in cities (Coulombel et al., 2018) and contributes significantly to local pollution (NO<sub>x</sub>, fine particles). The sustainable supply chain seeks to reduce these impacts through innovative strategies (green logistics, pooling, clean vehicles). The growing demand for last-mile deliveries is increasing urban emissions (Hurlimann et al., 2021).

This work delves into the intersection of sustainability and logistics, beginning with a case study on Tunis, which highlights the challenges of congestion and emissions in urban freight transport. Using the CORINAIR and ATESAME models, the

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