


Chapter 9

Logistics Sprawl and Artificial Intelligence Revolving Urban Freight Transport

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ABSTRACT

Artificial intelligence has made great strides in various fields, especially in improving logistics operations and freight transportation. This chapter aims to highlight the importance of applying AI to manage logistics sprawl phenomenon. The research focused on analyzing the impact of AI use on the performance of urban freight transport under logistics sprawling conditions. To achieve this, the authors carried out a literature review to explore the use of different AI categories including machine learning, deep learning, natural language processing, visual data processing, reinforcement learning (RL), and specialized algorithms, to optimise freight transport activities within a logistics sprawl context.

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I. INTRODUCTION

The urbanization level has significantly increased and affected different sectors, including logistics and freight transportation. In the different countries of the globe, the city's population, structure, size and freight demand continues to grow leading to the logistics sprawl phenomenon (Dablanc, 2014a). This phenomenon involves the relocation of warehouses, distribution centers, and other logistics facilities from urban centers to the outskirts, or even rural areas (Dablanc & Browne, 2020). It provides a dense area where most logistics activities and infrastructure are clustered, this movement contributes to distressing the city center and managing logistics flows complexity (Rokicki et al., 2022).

Basically, the logistics sprawl is driven by several factors such as land availability, lower land costs and improved access to major highways (Moufad & Jawab, 2020). The main aim of this movement is to increase service quality, decrease delivery deadline, manage logistics flows, reduce costs, energy consumption and environmental emissions.

However, the relocation of these logistics activities to the periphery has presented significant challenges for urban freight transportation systems. Since, it increases distance between logistics suppliers and customers, it has led to longer travel times, higher fuel consumption, increased congestion, and greater environmental emissions (Aljohani & Thompson, 2016). This has also raised economic, energy, environmental, and organizational risks.

In response to these challenges, artificial intelligence (AI) has emerged as a powerful tool that can revolutionize urban logistics, control logistics sprawl, and enhance the efficiency of freight transport (Arif et al., 2019). AI encompasses various technologies, including machine learning, data analytics, and autonomous systems, used to improve decision-making, freight transport efficiency, logistics platform's location, demand predicting and intend to reduce energy consumption and the environmental impact of freight transport (El Yadari et al., 2022).

AI-based solutions including Machine Learning, Deep Learning, Natural Language Processing, Visual Data Processing, Reinforcement Learning (RL) and other Specialized Algorithms offer predictive analytics for demand forecasting, optimizing vehicle routing operations, and efficient resource allocation (Gui-E & Jian-Guo, 2020). Machine learning algorithms can analyze vast amounts of data to identify patterns and trends, enabling logistics service providers to make optimal decisions (Pretnar et al., 2017). Furthermore, autonomous vehicles and drones, powered by AI, have the potential to transform last-mile delivery, reducing reliance on traditional transportation methods and minimizing congestion. Moreover, AI can play a crucial role in real-time traffic management, helping in reducing congestion and improving the flow of goods in cities (Saoud & Bellabdaoui, 2018).

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