Chapter 1
AI as a Catalyst for Sustainable Supply Chains:
From Carbon Reduction to Territorial Competitiveness

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ABSTRACT

The sustainability of supply chains has become crucial in the face of environmental challenges and heightened global competition. In this context, artificial intelligence is emerging as a potential catalyst for converging economic performance requirements and current environmental concerns. Transformation towards sustainable supply chains with reduced carbon footprints and territorial competitiveness calls for a thorough re-reading of theories on the role of AI. This chapter proposes an integrative framework to analyze the role of AI as a catalyst for this sustainable

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and resilient transition with a view to enhanced territorial competitiveness. This model is based on a critical review of the literature. AI, via its vast forecasting, optimization and automation capabilities, facilitates carbon reduction and enhances competitiveness. The proposed framework identifies causal mechanisms and moderating factors. AI is a powerful but conditional catalyst, requiring strategic alignment, organizational capabilities and ethical governance. Managerial and political implications are discussed.

1. INTRODUCTION

Today's supply chains are faced with a double dilemma: on the one hand, increased and fierce competitiveness demands greater responsiveness and flexibility, and on the other, environmental challenges exacerbated by the growing importance of ecological movements, which are increasingly shaping consumer habits. Indeed, from supplier to customer, via a distribution chain of varying length, supply chains are responsible for a very large proportion of greenhouse gas emissions (notably CO_2), but they are also vectors for value creation and are at the heart of contemporary international trade. Whether in terms of image for companies, or competitiveness for regions, managing the sustainability of supply chains has become a key issue.

It is in this context that the use of the various technologies offered by artificial intelligence (AI) offers interesting prospects for catalyzing efforts to transform supply chains towards sustainability and ecological resilience, combined with economic and financial imperatives: the use of AI to make these chains “greener” is an increasingly popular area of research (Zejjari and Benhayoun, 2024). Thanks to its capacity to acquire, process, analyze and store data, AI is an important vector for transforming logistics practices and processes, as well as the related business models. AI is increasingly being used in virtually all sectors to reap its benefits in terms of cost and time reduction, as well as resource and process optimization. The transport and logistics sector are not lagging behind, and is one of the sectors where the use of AI technologies is ubiquitous, as Figure 1 shows (Chui et al., 2018) (although to be taken with caution, as those are 2018 statistics covering a time horizon of 3 years ahead).

In the face of global warming, reducing the carbon footprint of greenhouse supply chains is becoming a necessity for companies, who are encouraged - and sometimes forced - to make efforts in this direction. Besides, territorial competitiveness now includes an environmental component that goes beyond the economic and social dimensions traditionally attributed to it. This is precisely where AI comes into play, by optimizing the economic, social and environmental performance of supply chains, leading to sustainable regional competitiveness. The coexistence of these 2

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