

Chapter 11

An Examination of the Impact of Artificial Intelligence on Maritime Port Efficiency and Businesses

Adeola Oluwatoyin Osundiran

 <https://orcid.org/0000-0002-9883-1528>

University of South Africa, South Africa

Tshehla Makgopa

 <https://orcid.org/0000-0002-3536-2517>

University of South Africa, South Africa

ABSTRACT

This study examines the impact of AI on the Port efficiency of selected ports in Europe, Asia, and North America. Inefficiency at the Ports has a detrimental effect on importers and exporters. The study framework relies on the Benchmarking theory. Research has shown that port delays have a negative multiplier effect on the economy. This study examines the implications of AI on the port efficiency of selected smart ports in the industry, such as Singapore, Rotterdam, Hamburg, Antwerp Bruges, Montreal, Long Beach, Valencia, and Barcelona. These ports serve as a benchmark for traditional sub-Saharan African ports. The implication of AI on Port Efficiency will serve as an impetus and a benchmark for other ports in Africa to consider AI a plausible solution to the long-standing inefficiency problems plaguing ports in sub-Saharan Africa. The Malmquist Productivity Index measures these ports' efficiency and productivity for 2017-2023. The result showed that four ports, Hamburg, Singapore, Valencia, and Rotterdam, had a Malmquist Productivity Index greater than 1. These ports can be used as a benchmark for sub-Saharan African Ports that have yet to transform into smart ports. The research developed a generic transformational framework to guide traditional ports.

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INTRODUCTION AND BACKGROUND TO STUDY

This study examines the implication of Artificial Intelligence (AI) on maritime port efficiency, especially amongst selected smart ports located in Singapore, Rotterdam, Hamburg, Antwerp Bruges, Montreal, Long Beach, Valencia, and Barcelona. Ghosh and Thirugnan (2021) opine that Artificial Intelligence (AI) is the branch of computer science that makes computers imitate human behavior in such a way that there is improvement in human performance. The beauty of AI lies in its potential and ability to improve port performance, which will benefit import and export-led businesses. AI is digitalizing transportation at sea, on land, and in the air, hence having the critical elements to reduce human error and accelerate operations (Ghazaleh, 2023). According to MacKinnon et al. (2020), AI may be the panacea for improving safety and efficiency in shipping. A seamless port has a short turnaround and berthing times for vessels, smooth procedures, and high customer satisfaction (Port of Rotterdam, 2024).

According to OECD (2024), the main mode of transport for global trade is ocean shipping: 90% of traded goods across the ocean waves move via vessels through the ports. Ports are pivotal to economic activity in offshore areas as they take up the role of both entry and exit points to the world for transportation in the international trade process (Farzadmehr et al., 2023). Farzadmehr et al. (2023) posit that ports are a pivotal link between sea and land transport. Maritime Transport is a system that integrates and includes the design, construction, operation, management, servicing, and maintenance of merchant, leisure, and the maintenance of ships in the service of seaborne trade (Matekenya & Ncwadi, 2023). This includes the transportation of people and cargo from origin to destination by sea or via inland waterways (Matekenya & Ncwadi, 2023). Maritime transport forms the spinal cord for global logistics, as it facilitates the movement of containerized, bulk, and various types of general cargo (Dinh et al., 2024). Li et al. (2023) state that cargo and containerized goods that are shipped via oceans need to pass through at least the ports of origin and destination if not transhipped at any other ports in their journey.

The efficiency of transport systems is critical as they provide economic and social opportunities that result in an indisputable multiplier effect, such as better accessibility to markets, employment, and additional investments (Rodrigue et al., 2017). AI has a pivotal role to play in enhancing port efficiencies. Container ships tend to wait less time in ports in developed economies than in developing countries due to a combination of faster clearance times, better infrastructure, and higher labor productivity (UNCTAD, 2023).

One of the obvious indices of port inefficiency is delays at the port, which can be caused by different types of challenges, such as unpredictable weather, diverse types of cargo kinds, and changes in port conditions, all of which can raise operational expenses (Dinh et al., 2024). Other major causes of such inefficiency are the burden of paperwork, inefficient information sharing among stakeholders, and lack of transparency and efficiency in ports' operations. (Li et al., 2023). Smart Ports are supported by technology that upgrades maritime transport so that the port services rendered are improved. Hence, the needs of stakeholders are satisfied (Valencia, Port, 2024). When the port lacks efficiency, it also lacks sustainability (Port of Rotterdam, 2024).

Dinh et al. (2024) state that AI can assist in predicting the accurate projection of a ship's total time spent in port and the prediction of possible delays. This is critical for effective port activity planning and management. The application of blockchain technology in the maritime industry can improve customs clearance efficiency and logistics transparency in container cargo supply chains (Wang et al., 2021).

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