

Chapter 3

Securing Sustainability Through Artificial Intelligence and Blue Economy

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ABSTRACT

The blue economy has gained considerable significance as a critical global catalyst for sustainable economic growth through the practical usage of marine resources. In this context, artificial intelligence researchers can substantially contribute to this growing field of knowledge. This work discusses new technology developments that facilitate the establishment of successful strategies for the digital transformation essential to the blue economy, where the role of artificial intelligence in securing sustainability within the maritime sector is explored. The work further discusses the need for advanced environmental protection and the related economic impacts. Moreover, the study will explain various facets and applications of digitization for the blue economy and sustainability. Furthermore, case studies on implementing new technologies within the context will be explained.

1. INTRODUCTION

The Earth's surface primarily comprises oceans and seas, constituting almost two-thirds of its total area. These extensive bodies of water are essential to the operation of our planet. They provide sustenance and minerals, aid in oxygen production, sequester greenhouse gases, affect meteorological patterns and temperatures, and enable international commerce via ocean routes. Moreover, international shipping and ports are essential to global supply chains, enabling countries to access worldwide markets. Approximately 80% of global trade volume is conveyed via maritime transport, underscoring the importance of these connections (United Nations Environment Programme, 2024).

Urgent intervention is imperative to combat the damaging elements, such as commercial container discharge, hazardous waste disposal, and pollution from human activities, which are inflicting significant harm on marine and atmospheric ecosystems. With the projected population growth and rapid industri-

DOI: 10.4018/979-8-3693-7893-9.ch003

alization and urbanization, these efforts are set to escalate. The role of oceans and seas in sustainable development cannot be overstated (International Maritime Organization, 2024).

Therefore, it is imperative to propose innovative approaches or frameworks to effectively address the difficulties and aid in identifying detrimental aspects of ocean sustainability. The establishment of information and communication technology infrastructure is essential prior to the widespread use of digital solutions in both commercial and personal contexts. Recently, specialists from several disciplines have collaborated to develop advanced systems for the intelligent monitoring of the environment, leveraging breakthroughs in artificial intelligence (AI). AI has proliferated across various systems and applications, encompassing activities such as data monitoring, recognition, categorization, and interpretation (Hossain et al., 2021; Ceylan et al., 2023).

Moreover, recent research indicates that the application of big data, AI, the Internet of Things, and virtual reality in the maritime sector is congruent with the notion of digital transformation (Battineni et al., 2024). This idea precisely characterizes the caliber of models dependent on digital technologies. AI can forge a significant connection among stakeholders directly or indirectly in producing goods and services inside the blue economy. Furthermore, the Internet of Things can be employed to regulate and manage traffic at ports and oversee warehouse operations. Moreover, augmented reality technology enriches cultural and historical tourism in coastal regions, as developing “smart destinations” generates new economic opportunities and employment prospects. Moreover, autonomous vessels are exceptionally efficient and safe for the surveillance of subsea pipelines in maritime engineering.

Furthermore, the advancement of offshore wind energy and the adoption of digital solutions will greatly enhance port and shipbuilding activities, along with the operations of maritime equipment suppliers and operators. The implementation of technological developments in aquaculture farming is anticipated to improve productivity and reduce negative environmental effects. This will yield a beneficial economic impact on both the future and previous acts (Brönnner et al., 2023).

The study of the blue economy, with its potential to create new commercial opportunities, jobs, and economic growth, is of utmost importance. Emerging digital technologies can accelerate the transformation of economies and society, steering them toward a more inclusive and resilient future. This research can provide valuable insights into how nations and enterprises might leverage the promise of the blue economy (Layman et al., 2022). The phrase “blue economy” encompasses many economic sectors and related policies that collectively impact the sustainability of ocean resource utilization. A key objective of the blue economy is to maintain a balance among the economic, social, and environmental dimensions of sustainable development related to oceans. This requires a comprehensive understanding and effective governance of several aspects of oceanic sustainability, including sustainable fisheries, ecosystem integrity, and pollution management. However, achieving this balance is challenging in practice due to the limited availability of ocean resources and the significant deterioration of ocean health caused by many human activities, including carbon dioxide emissions and nutrient and chemical pollution, as previously mentioned.

The blue economy is extensive, hence generating a significant volume of data. Diverse sectors, encompassing governmental bodies and corporations, provide significant volumes of ocean-related data. This data includes shipping manifests, wind velocities, subaqueous photos, and acoustic information. The significant amount of data requires sufficient opportunities to collect further data and efficiently leverage existing data to improve operations and attain superior outcomes. Inadequate data correlation and interpretation will lead to a lack of concrete results (Doce et al., 2024). The technological aspect of the blue economy emphasizes the utilization of advanced technologies in marine robotics, sensors,

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