Implementation of Artificial Intelligence Internet of Things (AI-IoT) its applications and challenges in Maritime Supply Chain Management

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ABSTRACT One of the most significant sectors for world commerce is the marine time supply chain. When compared to other industries, the marine industry lags behind in the digitalization of other sectors, like production, medical, water supply, transportation, and shipping. IoT technologies and the near real-time data they can generate and offer extra incentive to enable malfunction detection, sustainability, tracking and avoid delays. The main objective of this paper is to shed the light on the implications of AI-IoT for the maritime supply chain and its advantages. The findings reveal that implications of AI-IoT for the maritime Supply chain can be used as a sustainability tool as well as a larger philosophical framework for tackling sustainability issues with mitigating malfunction and delays. According to studies, the sustainability area appears to be seeing the highest growth of AI and related technologies in the marine supply chain management industry.

KEYWORDS Artificial Intelligence; Internet of things, Supply Chain Management

I. INTRODUCTION

Marine time supply chain means the flow of cargo or goods, using both land and ocean transit between two locations. It is a huge network of interconnected systems that comprises freight forwarders, transhipment operators, cargo ships, and land-based logistics systems.

A marine supply chain is crucial for any economy since over 70% of the world's value more than 80% of its quantity is moved by water (sea, ocean). COVID 19 has shown how interruptions to the global supply chain may result in widespread economic and governmental problems. digitalization has taken the world to the next level [1]. In this modern world everyone is concerned about the environment and moving for sustainable lifestyle. The marine sector is pushing forward to green up its commercial activities in response to pressure from consumers, society, and local and international regulatory organizations. Which is why it has started implementing sustainability measures to satisfy emissions limits, lessen the effects of marine pollution and climate change, and use green technologies, [2]. Many researchers who favour the use of digitalization in the global supply chain, which may provide important skills, has grown in recent years: As evidenced by improved information exchange and upheld regulatory obligations, supply chain management (SCM) is essential for ensuring products quality in the complex global supply chain operations [3]. Digitalization could improve the physical, environmental, economic, and social aspects of transportation sustainability [4].The study's objective is to shed light on the implications of AI-IoT for the maritime supply chain and its advantages.

II. LITERATURE REVIEW

AI-IoT is receiving a lot of attention from numerous industries, due to its remarkable Characteristics and Innovative Features. Regarding the effects of such developing technologies, scholarly journals [5] .Significantly supports the perspectives from experience. Substantial improvements in supply chain and logistics systems are being caused by these technical advancements taken altogether.

The AI gives shipping staff the ability to quickly, deeply, and accurately model fleet management, use cases, and very accurate prediction models—capabilities that were not possible using more conventional techniques. No skill of data science is needed. Throughout the supply chain for goods and

fresh produce, the use of sensors and other IoT devices is crucial for producing observations on circumstances pertinent to the items being transported [6]. A number of businesses used IoT technology for real-time information analysis to keep track of their human resources. Because of its freshness, a theoretical and methodical framework that may be employed for the traceability of supply chain views is not yet available in supply chain perspectives [7]. Due to SC developments, businesses around the world are now increasingly concerned with timely, quick delivery as well as the transparency and traceability of their products [8]. The present research on marine supply chains have only looked at a small number of adoption obstacles. In their theoretical foundation [9], [10]. Because of its broad coverage, numerous economic operations, such as the expansion and/or modernization of port infrastructure and marine transportation networks between more than 65 nations, have been and will continue to be conducted. Global marine supply chains have gotten more complex as a result [11], [12] , and making the necessary change. Identify three primary application issues, including legal, operational, and technological difficulties. 20 barriers to marine transportation were highlighted by [13], [14] after conducting a review of the literature. These hurdles included an inadequate set of guidelines and consensus, a lack of guidelines, investor resistance or hesitation, poor data excellence, a lack of knowledge, electricity, and inadequate maturity [15], [16] identified six main obstacles to the adoption of innovative technology in the maritime sector, including: a lack of standardization authority; interoperability and scale issues; restrictive trade practices and commercial confidentiality; environmental problems; conflict resolution; and information leakage and cyber – attacks. However, according to adoption of distributed ledger technology in the maritime supply chain would only be successful if all involved parties are engaged on blockchain applications, according to an analysis of hurdles and significant parties in container - based global trade. For security and logistics purposes, RFID and GPS can be employed to trace the transit of containers across freight ports [12], [17]. IoT technologies and the nearly actual info they produce give additional impetus to improving asset problem diagnostics and preventing interruptions brought on by asset failure. Such solutions also need for trustworthy communication channels to handle both high bandwidth and low latency. In order to do this, [18] . constructed a 5G-based IoT asset management system at the Port of Felixstowe, the largest container port in the UK. Other benefits from innovative technology i.e., blockchain is offering digital platform for a variety of applications related to environmental sustainability [19].Nowadays, the Web and other cutting-edge services, such those built on blockchain and the Internet of Things (IoT), are regarded as creative ways to address supply chain difficulties [20].

III. AI-IOT IN THE MARITIME SUPPLY CHAIN MANAGEMENT AND ANALYSIS

Numerous new technological innovations are already altering how warehouses and logistical firm's function. Passive RFID tags differ from active RFID tags in that they have a chipset for data processing in contrast to an RFID antenna, but active RFID tags are self-powered and occasionally have the ability to incorporate additional sensors. Asset tracking is one of the biggest trends that will revolutionize supply chain operations. because it grants businesses a means by giving them the skills to make better decisions and save time and money, to fully revamp their operational efficiency [21].

IV. APPLICATION OF AI-IOT IN THE MARITIME

AI-based technologies are gaining more and more interest in a number of subject areas related to environmental, sustainability, and climate disciplines. [22], [23].Include "smart" urban design for sustainable growth, AI applications in climate and Earth system modelling, Intelligence ecological control, remotely operated data collection and underwater marine conservation actions, and AI-supported surveillance of illegal wildlife trading [24] [25]. The concept of "automated systems," or advanced technological homologs of intricately dynamic systems employing "huge" actual information, has drawn more interest in the green domain. Such tools give their users the ability to model, investigate, improve, and help detect hazards in a variety of fields relevant to sustainability goals, such as building infrastructure and diverse resource-consuming systems [26] [27], [28]. Sustainable applications of AI and associated technologies could be seen as examples of innovative "specialty" that, if supported by extra funding, appropriate legal frameworks, and heightened public and consumer demand, could scale up quickly and spread widely [29].

V. THEORETIC ARCHITECTURE OF AI-IOT BASED MARITIME SUPPLY CHAIN MANAGEMENT

There are several reasons why businesses should consider integrating AI-IoT into their supply chain and business strategies [30]. In this regard, it has been shown through in order to locate products, commodities, and facilities as well as to be aware of their current state and environmental circumstances, the research at hand suggests that AI-IoT can be useful in product tracking [31]. Food suppliers can increase consumer confidence in food items by utilizing IoT and depending on the technology's detecting abilities to handle their food safety procedures effectively and efficiently [32]. Studies in this cluster have also supported the development of intelligent logistics activities using decision support systems (DSS) to manage industrial food operations, ensure tangible product provenance, and keep accurate shelf-life forecasts. Along with IoT technology, situation argumentation (CBR) has also been used to address the worldwide issues affecting the management of supply chains for food [33].

The decentralization, openness, independence, and security that characterize AI-IoT are used in the design of the

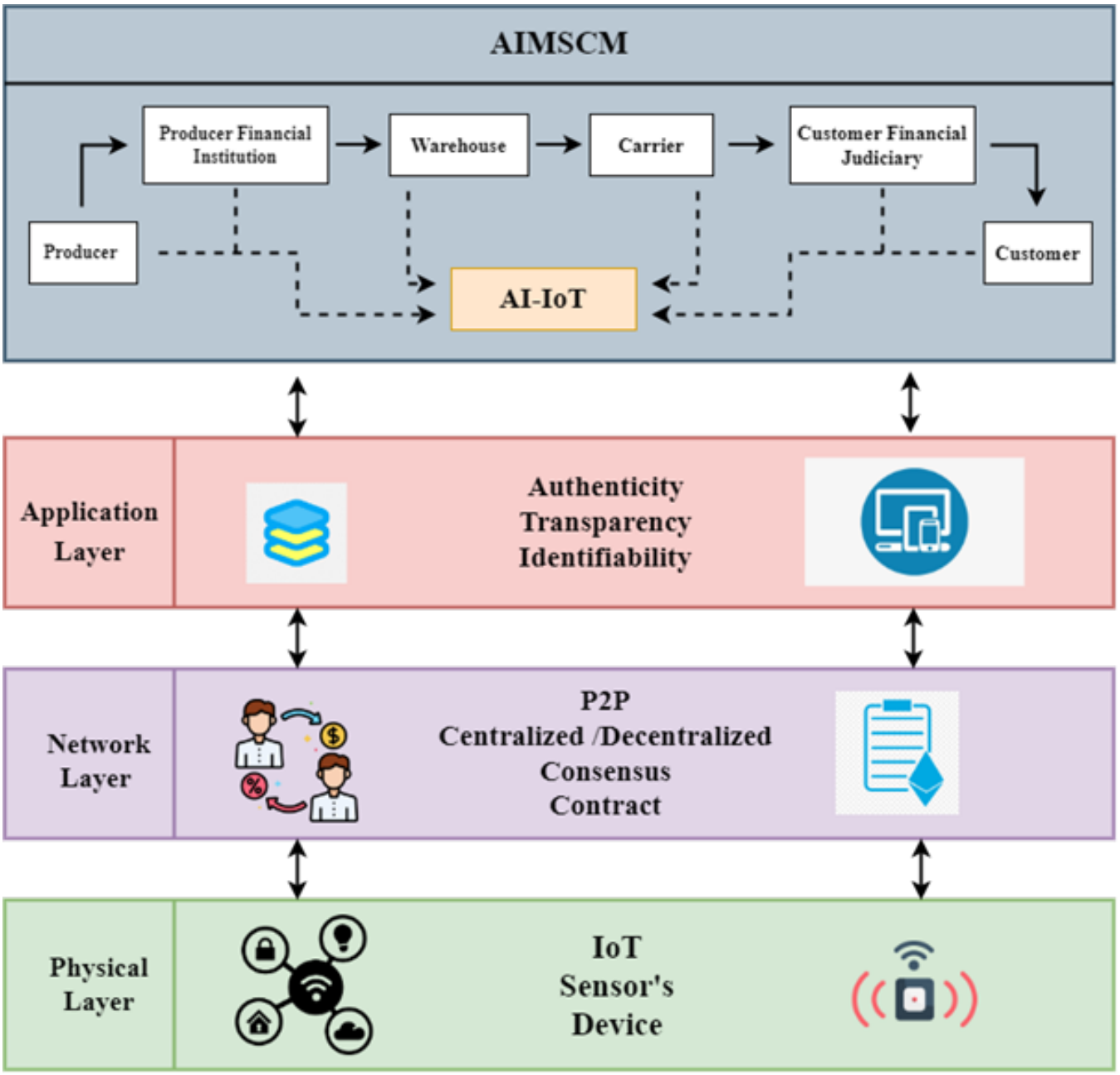

FIGURE 1: AI-IoT based Maritime Supply Chain Management System

AIMSCM. A maritime blockchain network is created between multiple nodes to conduct smart operations, scheduling, maritime service, control and monitoring, and information transfer including producer, warehouse, carrier, and customers. We coordinate the major supply chain nodes to create an open AI-IoT network that is open and transparent and completely protects everyone's privacy in light of the problems in the maritime industry. In order to effectively integrate the four streams of business, information, capital, and logistics in the maritime supply chain system and ultimately increase the operational management effectiveness of maritime firms, we develop a model.

VI. CHALLENGES OF MCSM BASED ON AI-IOT

AI-IoT is ongoing and rapidly upgrading technology, regardless of the development it is still undergoing through the challenges, that are ought to be addressed. The top issues are, in listed in that sequence, operational cost, a lack of reliable partners, a lack of data confidentiality, a lack of knowledge about AI-IoT, apprehension about changing the way things are done, and scalability. [34].With logistics companies that like to maintain information gap between networks and logistics providers and exporters who prefer to keep their client and transaction data as private as possible, managing confidentiality and business information sharing

issues around AI-IoT implementation would be incredibly challenging. Examining impediments to and important stakeholders in containerized international trade, we may examine the adoption of Hyperledger fabric in the marine supply chain. In their conceptual [9] analysis, identify three primary technology problems, including regulatory, administrative, and technological difficulties. How do ports improve their efficiency is one of the biggest problems MCSM now encounters. The availability and effectiveness of crane operation is important for the ports' productivity [35].Because of the high pressures and cyclical loads cranes endure while operating, which makes them vulnerable for failure. Benefits from the IoT application for the port Felix toe status assessment. One of the most crucial issues to deal with throughout an IoT implementation is ensuring effective communication. The most widely used IoT technologies are Wi-Fi, Bluetooth, Zigbee, RFID, cellular, Lora Wan, Sigfox, and NB-IoT. Most IoT programs employ a combination of these technologies to enable communicating effectively and efficiently [36].

One of the biggest obstacles to the greater use of hydrogen in the marine industry is fuel storage. Many strategies, from pure physical storage to chemical storage, have been considered for preserving hydrogen aboard spaceship .A typical tendency in hydrogen storage systems would be that hydrogen stored biologically is much less accessible than hydrogen kept biologically, and that hydrogen release from chemical storage requires more energy or heat [37] [38]. The argument over food versus fuel is the key issue that might prevent biodiesel from being widely used in the maritime industry. Challenges in adopting clean energy on the basis of business, engineering, and administration in the maritime sector: A comparison of alternative fuels. The top issues are, in cost of implementation, lack of capable partners, lack of information security, knowledge of AI-IoT, anxiety over changing organizations, and adaptability are stated in that sequence [34] [39]. When we've covered in previous sections, as humans, technology, and ecologies interact differently as a result of the development and adoption of artificial intelligence (AI) [40] and more automation, there are various understudied systemic hazards as well as opportunities for sustainability. The application of the principles defining "responsible AI," that have arisen in recent years, particularly those that address justice, non-discrimination, governance, transparency, confidentiality, and privacy, could potentially mitigate some of these concerns. Thus, ethics policies have taken the lead as the method of control for AI systems [41].

VII. ARTIFICIAL IOT SYSTEMATIC RISK AND SUSTAINABILITY

AI-IoT is ongoing and rapidly upgrading technology, regardless of the development it is still undergoing through the challenges, that are ought to be addressed. The top issues are, in listed process of installation, shortage of capable partners, a deficiency of data protection, an insufficient understanding of AI-IoT, anxiety over changing organizations, and adaptability are listed in that order [39]. With logistics companies that like to maintain information gap between networks and logistics providers and exporters who prefer to keep their client and transaction data as private as possible, managing confidentiality and business information sharing issues around AI-IoT implementation would be incredibly challenging [42].In their conceptual [9] analysis, identify three primary technology problems, including regulatory, administrative, and technological difficulties.How do ports improve their efficiency is one of the biggest problems MCSM now encounters. The availability and effectiveness of crane operation is important for the ports' productivity [35]. Because of the high pressures and cyclical loads cranes endure while operating, which makes them vulnerable for failure [18].One of the most crucial issues to deal with throughout an IoT implementation is ensuring effective communication.

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The top issues are, in listed costs associated with implementation, lack of capable partners, lack of data protection, understanding of AI-IoT, fear of modifying operational structures, and adaptability are listed in that order. [39].When using AI and related technology to achieve sustainability goals may result in systemic hazards. If these risks are not aggressively addressed, gains might be undone and even sustainability could be reduced. Since these risks are not aggressively addressed, development might be undone, and perhaps even sustainability could be reduced. There are trade-offs between effectiveness and durability, which are connected to algorithmic bias and factors of production damages; uneven accessibility and advantages; cascade failures and external disruptions; and unequal access and benefits. Training data inaccuracies and contradictions, cyberattacks that damage data collection and autonomous mechanisms for making decisions, and incorrect Ai technologies can all have negative effects when the use of AI-IoT systems, as has been demonstrated in other fields including law enforcement and the health sector [45].Notwithstanding growing interest and investments in these technologies, these internal and external dangers caused by innovative interactions between people have received little attention thus far [29].Here risk mean the potential for harm, which is frequently measured as the sum of the likelihood and seriousness of the [46]. We especially allude to the need for the ecosystem and a sustainable Earth system for continued human advancement and well-being when we use the term "sustainability" [47] [48].Although

it may seem unjustified to mention this as a potential risk, early research suggests that the financial advantages of Ai systems in agriculture appear to be maximum for farmlands that can spread their operating expenses over several acres, and that mechanisation can lower labour costs [49].It is difficult to determine whether the risks are inherent to AI and key technologies taken by individual or the result of "choreography problems" brought on by novel applications of AI-technologies in innovative social and environmental contexts because these technologies are still in the initial stages of development and application. [50].

VIII. CONCLUSION

In the interest of sustainability, The maritime supply chain management sectors look to be gaining momentum in terms of automation, automation, and cognitive computing. Pressures from society and the environment, as well as technology breakthroughs, are what are causing these technologies to spread. On the technical front, advances in predictive analysis made possible by various Increasing processing power, earth observation, IoT systems, and rapid innovations in the AI industries have paved the way for novel methods of productivity, efficiency, and decision-making in the face of uncertainty. Research and development in this promising sector have also been sparked by societal needs to better manage scarce natural resources and comprehend the extent and effects of fast climate and environmental change. According to analysis, the marine supply chain management industries appear to be experiencing the quickest pace of AI development and related skills in the sustainability domain, with significant global expenditures in these technologies. The many types of computational flaws, externalities, and prospective networked risks that could come from such diffusion, as we explore, could lead to new kinds of systemic risks.

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