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AUTOMATION OF THE MARITIME SECTOR IS EXPECTED TO BOOST GLOBAL TRADE'S COMPETITIVENESS AND RESILIENCE

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ABSTRACT

Today, information technology is a hot issue in shipping scholarly and technological activity. Based on current facts, this study tries to establish a complete framework of digitalization technologies and their marine commercial consequences. To fully comprehend the complexities of maritime digitalization efforts, we handled both technical and managerial issues in a unified framework. The insights on recommended practices for implementation back up existing theory. These practices include a clear plan, top-down management, implementers and shift sponsors, transparent messaging services, participation of those undergoing change, and facilitation of activities that maintain the change. Lack of digital competencies; lack of leadership qualities; expense industry; the extended life cycle of vessels; competitive economy; industry in initial stages of digitalization; and business transformation while remaining operational are the problems of adopting change. The research adds to the existing theory of organizational change. Four steps of automatization are introduced in this research as "Management, assets, and functionality," IT and system assimilation, Advanced technologies and feasible remedies, Energy-saving, and improved performance. Methods of automation will first consider the current situation. Then the future state will be investigated following generating a framework. Data from the resources will be established. In the culmination stage, automation methodology will be applied. The analysis processes of digitalization accomplish the cost of fuel and lessen pollution.

Keywords: Automation, Digitalization, Marine.

I. INTRODUCTION

Marine shipment is an ancient means of international commercial shipping. When compared to plane travel, it is less expensive but takes longer. This mode is widely used in large-scale productions commodities (metal ores, wheat, and coal) and ships (petroleum, gas, and chemicals. However, intermodal traffic has grown rapidly, with volumes increasing at an annualized pace of 8.0 percent between 1980 and 2018. In 2018, cargo ports globally handled an expected 793.26 million TEUs (UNCTAD, 2019)

Conferring to the International Maritime Organization (IMO), about 90 percent of the world's skill is transported by sea, and the percentage is steadily growing. The high volume has created obstacles and possibilities for those involved in ocean shipping, port operations, and countryside distribution. They strive to reduce costs, increase efficiency and benefits, and increase their competitiveness in the global market share. Information and communication technology (ICT) has been accepted and evolved as vital support for these goals. ICT has significantly increased interaction among actors while also increasing the accuracy and performance of operations. (Zerbino, 2020). To send papers digitally, for example, Electronic Data Interchange (EDI) has been established. The goal is to replace paper documents with electronic counterparts. Port officials created the Port Community System (PCS) to handle administrative processes and port operations. It is a highly efficient means of handling a massive amount of information, particularly when container shipping. Because sea transportation includes many diverse players, this data system facilitates and accelerates Collaboration among cross actors. (Rajkumar, 2010)

It is used, for example, in customs processes for exporting and importing containers, which might take a long time in port. When PCS interfaces with the customs system, it saves time by avoiding the submission of the same papers several times, significantly improving clearance operations. To track vessels and avoid collisions, the Automatic Identification System (AIS) has been utilized. This improves maritime transportation safety and security. Since their introduction in the 1960s, information and communication technologies (ICTs) have been widely used in commercial, regulatory, logistical, and financial activities in marine transportation. They facilitate information transit, exchange, and sharing among various actors. However, most shipping sector players still handle papers manually during the legal mechanism, such as the Bill of Lading (BoL), Border control Declarations, and the Certificate of Origin. Inter-organizational information exchange platforms are out of date, and manual methods continue to be used in vast areas of the supply chain (Loklindt et al., 2018). Because operational actors may not always have all of the information they need, containers regularly come to a halt for nearly half of their route (Jensen et al., 2014). Because of a lack of coordination and information exchange, there is limited transparency and a generalized lack of confidence among the parties involved. It also increases the workload and offers a security concern. Information inaccuracies and delays have an impact on operational elements. The diversity of supply chain participants, their interactions, varying rules, and the cost of information contribute to supply chain obstacles that inhibit global commerce. As a result, the transportation sector desperately needs cost-cutting measures, such as attaining industry-wide digitalization of documentation exchanges (Loklindt et al., 2018).

Inadequate information organization leads to increased costs, reaching up to 20% of an operating budget (Den Norske Veritas, 2017). The key drivers of technology transformation are cost-cutting objectives, the high degree of regulation in the marine sector, such as eco-friendly aims, and the vast quantity of data that maritime enterprises must handle to perform more successfully (Gausdal et al., 2018). As a result, the sector has a significant opportunity to expand ICTs and enter a new age of digitalization. New ideas are exploding into our understanding of the marine business. Automation has been a term in recent years, particularly in the context of Industrial 4.0, eMaritime, e-Navigation, Intelligent Port, and Blockchain Bill of Lading, which are regularly cited in business and academic domains. This phenomena is due to the emergence of new digital based on the internet of Things (IoT), Data Management, Cloud Services, Cyber-Physical Systems (CPS), and Smartphone technology, among others. (Saravanan,2019)

Admittedly, the implementation of new technologies will impact the sector in a variety of ways, including business models, administrative processes, and logistical operations. Actors in the marine sector attempt to use new technology to improve operations and competitiveness to reap long-term advantages. For example, in a case study of 75 port-related innovation projects, 40% of examples improve information flow throughout the marine supply chain.

On the one hand, it demonstrates that the marine and port industries are interested in participating in the digitization trend; on the other hand, it also suggests barriers to action. Even though there is frequently an advantage balance for each actor, many of them are still on the fence since they can perceive the value. (Sys et al., 2015). The process of reshaping economies, organizations, including society on the system level is thus termed as digitalization. While information technology embraces adjustments on all levels in society, digitalization through the use of various technologies (e.g., cloud innovations, detectors, data science, 3D printing) opens up previously unimagined options. It offers the potential to generate completely new goods, services, and business practices (Rachinger, 2019). Because digitalization has been identified as an emerging trend in the marine sector, it is critical to evaluate what maritime commerce and logistics would look like under digitalization and its effects on maritime players. By examining the characteristics of each generation of automation, we can anticipate possibilities in the marine sector and respond to changes that occur.

Automation is a well-known game-changer in every other business, and automated technologies that were previously considered a pipe dream are now becoming a reality. In conjunction with intelligent machines, industry will offer up unlimited opportunities for bringing global shipping, freight forwarding, and supply transportation sectors closer together. Digitalization will allow vessel operators and other stakeholders to get insight from data, save time and money, enhance productivity, and optimize operations while optimizing the use of resources available.

An integrated automation system is required for the proper operation of marine equipment and auxiliary facilities. It guarantees that the equipment plant operates as a single functional unit and gives the operators alerts, controls, status information, and analysis tools. Increasing production rates and enhanced productivity are typically credited to automation, as are more effective work usage, better products, worker security, shorter labor working time, and quicker manufacturing lead times. The safety of workers is a major motivation for automating an industrial activity.

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The main objectives of the paper is listed bellow

- Strengthen the Resilience of the Maritime Supply Chain
- Reduce the expenses on fuel and Decrease the pollution concern
- Increase the production rates and increase productivity
- Efficient use of materials, enhance the safety

The paper is arranged as follows. Section II explains the Maritime Transport Services in the World Economy. Steps of automation are addressed in section III. Section IV presents the automation methodology. The work is concluded in section V.

II. MARITIME TRANSPORT SERVICES IN THE WORLD ECONOMY

Globalization and advances in transportation facilities resulted in a considerable increase in international trade in the second half of the twentieth century. Because more than three-quarters of global trade is transported by water, global service development has resulted in the development of marine services. In 1999, global seaborne trade increased for the fifteenth year in a row, reaching a volume of over 5200 million tonnes. By 2005, it is expected that seaborne freight would total 5350 million metric tonnes. In 1999, the sphere seagoing vessels grew by 1.3 percent to 799 million dwt, an increase of 1.3 percent from the previous year. Developed nations' tonnage ownership fell by 0.3 percent, while large open registration countries and emerging economies grew their fleets by 0.3 percent and 0.1 percent, respectively. Although industrialized nations hold the majority of ships registration in major open-registry countries, the amount of tonnage held by emerging countries has risen steadily, reaching roughly one-third of total tonnage in 1999.

Refining capacity (the vehicles and public of crude oil goods) accounted for 45 % underwater trade volume in 1997, though thirsty bulk traffic (the vehicle of coltan and phosphorous) and lining circulation (the transit of reasonably high traffic carried by cargo vessels, wrap vessels, and other vessels) accounted for 23 % and 32 %, respectively. Within that competitive global market, all countries are faced with the problem of constantly upgrading and modernizing their marine transportation systems to keep up with the fast rise in cargo flow. This necessitates new and enhanced technologies in both boats and land processes of havens and terrestrial transportation systems. Markets that are unable to deliver this type of operational climate risk losing customers.

The growing size and complexity of ships and sea ports necessitate significant capital expenditure, which is sometimes beyond the capacity of many developing nations' public sectors. As a result, there has been a growing trend toward privatization, global partnerships, and worldwide networking. Those that do not care about climate change risk losing ground. Despite the fact that government agencies both in industrialized and developing economies agree that a liberalisation seafaring conveyance region would allow stockholders to spontaneously function shipments, port facilities, and ancillary activities, thereby facilitating employment, financial and deliberate factors have frequently stymied the development of liberalization. As a result, there is still a major interaction between discriminating and non-discrimination legislation in this industry.

Maritime transport moves roughly 10 billion tonnes of cargo, liquid and solid bulk freight across the earth's crust each year, accounting for 80–90% of global trade (Walker et al., 2019). Individuals and products must travel by sea across continents and across seas throughout history. Although air travel proved superior for perishable and high-value commodities, marine transportation can successfully and efficiently transfer practically any items. By leveraging on the potential of internal combustion, the industrialization boosted ship transportation even more, and the later adoption of container shipping drastically revolutionized marine transportation once more in the name of efficiency. Another change in marine transport was the practise of "containerization," which eliminated the requirement for ships to be designated to a specific commodity (because all are housed in a basic product) and fully leveled inter-modal connections. Due to a 20-foot vessel, cargo capacity via multiple modes of transference may be quantified in container units, known as the 20-foot corresponding unit or TEU. More frequently than not, the vessels comprehended on highway automobiles and huge transportation boats are 40 F long, or 40 foot corresponding units (FEU).

According to the United Nations (UN), there had been 94,171 industrial vessels in the worldwide fleet at the start of 2018 (Fig. 1 for a complete overview by ship type, and Table 1 for a more total breakdown by region)

(UNCTAD, 2018). The majority run on diesel, and its productions are harmful to the environment. Each of these boats has its rocket engine, making it a consumer as well as a converter of energy.

The impact of international shipping operations to rising temperatures is calculated using these accessible (which use new resources and create new trash). Water transport is a critical element of the climate change mitigation jigsaw, given the generates the corresponding of these boats, their growing social and economic reliance on them, and the concurrent need for greenhouse gas reductions. According to the International Maritime Organization (IMO), sea transport accounts for around 2.2 percent of anthropogenic-based pollutants in 2012, dropping from 2.8 percent in 2007 before the global financial slump.

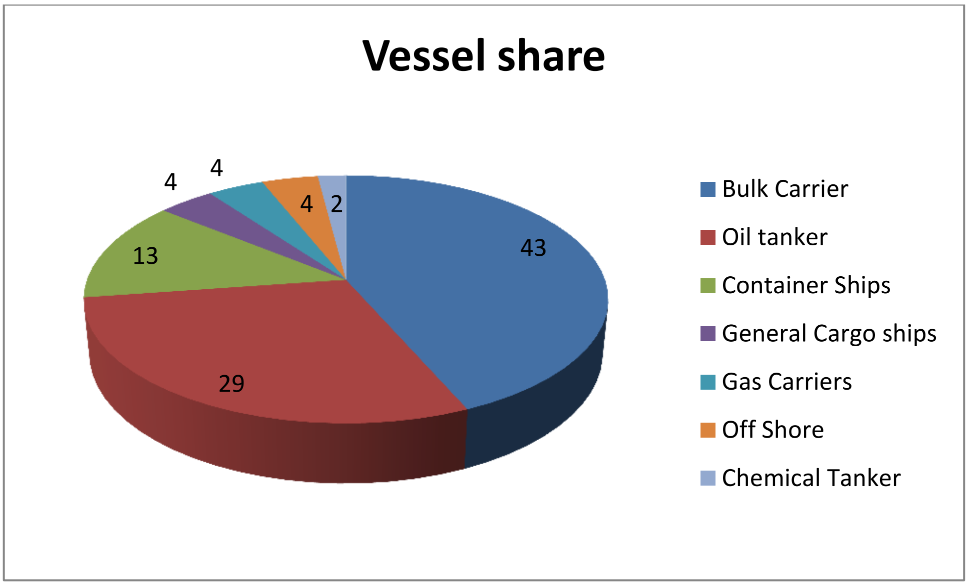

Fig 1. World vessel share (UNCTAD,2018)

Table 1. Total breakdown by region

Country	Indonesia	Panama	Japan	China	US
Number of vessels	8782	8052	5289	4287	3611
Best 3 experts	Coal, palm oil, gasoline gas	petrol, coal, bananas	vehicle quantities, ICs,	Communications paraphernalia, processors, office machine parts	gasoline, coaches, airplanes

Human transport, armed and defense, fishing or aquatic resource uses, and maritime assistance such as navigating and vessel repair are all included in maritime vessels. All of these uses contribute to the total environmental effect of ocean shipping, not in the same way as trade does.

III. STEPS OF AUTOMATION

Automation and new advances in artificial intelligence, blockchain, IoT, and mechanization have become increasingly important in marine transport. They assist to simplify current operations, developing new business possibilities, and revolutionizing supply networks and trade geographies. Despite the potential, possibilities, and advantages given by these technologies, they also carry dangers and possible costs for maritime operators in poor nations. As a result, a level playing field must be established.

The influence of digitization on marine transportation may be classified into five stages:

a. Consider your current situation.
b. Investigate your future state
c. Create a framework
d. Accept data as a resource.

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e. Automation Methodology

a. Consider your current situation.

Examine the datasets carefully. What kinds of information do you gather from your organisation? Who is the recipient of this information, and what purpose does it serve? How is data handled throughout its life cycle - how is it gathered, validated, cleaned, delivered to downstream systems, safeguarded, and validated? With a comprehensive examination of the data on which you base your choices and how they are made, you can begin to sketch out the data architecture that will serve as the foundation for your digitalization.

b. Investigate your future state

In an ideal world, what would you like to do with the information? Where can such a data provide the greatest value to your company? What impact may this have on your company's success? Perhaps the statistics can assist you in demonstrating increased transparency in the face of rising supply chain instability. You may want to expand your firm aggressively through additional bandwidth, client acquisition, or infrastructure initiatives. Perhaps this statistics can assist you in improving service quality and increasing client loyalty in a crowded marketplace. To prioritize data, begin with your company's objectives and move backward.

c. Create a framework

Prior to embarking on a digital transformation program, prioritize data integration (as defined above). Create a framework to handle all of your data to ensure that the data is correct, vetted, consistent, and ready to enable automation and analytics across several user groups. There is a fundamental lesson to be learned from the initial wave of sectors that launched on digitalization, many of which ignored this essential step and discovered that their data-driven projects were not providing the intended benefit in the absence of the correct data governance architecture.

d. Accept data as a resource.

Data management is frequently a problem for organizations transitioning from manual to digital processes. This method results in lost opportunity, inefficiency, and undue danger. Your business can instigate to utilize data to decrease risk, augment service distribution, and energy growth via effectiveness, invention, and general efficiency with an organized data. However, you obligation chief acknowledges data as a valuable tool in your company culture. The knowledge that statistics is an asset must come from higher down, from customers who influence the business and a recognition of the worth that numbers deliver.

e. Be upfront with yourself about your talents.

Data needs for the marine sector are rapidly growing more sophisticated than in-house tools can handle. Sustaining these skills internally is difficult, moment, and diverting from the core product for many. External provider information management may offer the best of the two by allowing individuals to read the information they need to accomplish their jobs while reducing the work necessary to maintain the fundamental methods and software that ingest, clean, aggregate, and disseminate that data for acceptance.

IV. AUTOMATION METHODOLOGY

In the marine industry, the move to digitization and automation is accelerating. Digital technology and solutions are being leveraged to improve operational efficiency and increase competitiveness. They are also being adopted to accelerate the industry's decarbonization in order to achieve minimal environmental impact from maritime trade by mid-century. Digital data from sensing and certain other available data may be utilized for decision-making and improved monitoring, control, performance measurement, and verification.

Maritime players must reconsider and adjust their present strategy to ensure efficient, environmentally friendly policies and boost short- and long-term viability. The items listed below must be examined during the political programs. The method of automation have following steps as shown in Fig.2.

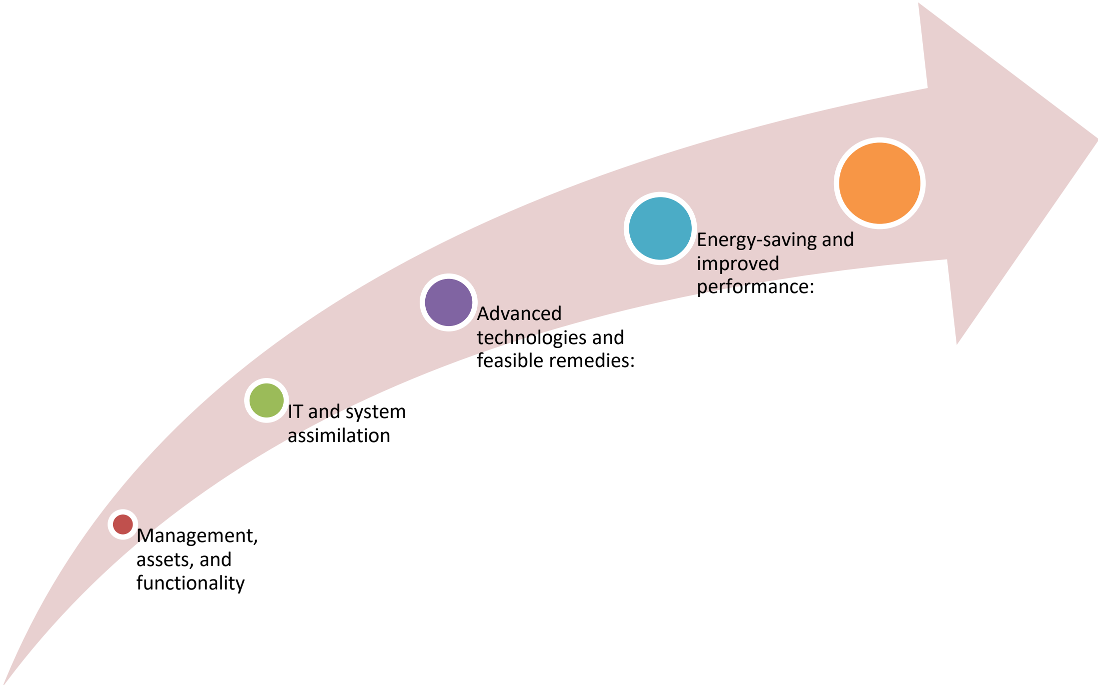

Fig 2. Automation Methodology

a. Management, assets, and functionality

Management resources are intangible assets such as managerial talents. Administrative capabilities refer to managers' ability to lead companies and enact strategic and tactical choices by influencing and coordinating external resources, inputs, and capacities. The step adopted for enhancing the managerial functionality is presented in Fig.3.

Fig 3. Enhancement of Management, assets, and functionality processes.

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b. IT and system assimilation

A collection of interlinked computer-based systems that allow electronic computing systems and surveillance, management, and vessel control systems, as well as centralized accessibility to information and/or instruction. An integrated system may include processes for quotation implementation (e.g., steering, variable speed, vehicular surveillance, journey planning); industrial equipment management (e.g., power saving, machinery tracking, heating oil transfer); cargo (e.g., cargo tracking, inert gas creation, loading as well as emptying); and so on. The process of IT and system assimilation is presented in Fig.4.

Fig 4. An updated IT and system assimilation

Assimilating the Integrated Bridge System (IBS)

It is "a network of interrelated and tightly grouped displays and modules that offer rely principally to navigation, propulsive, management, and measure data." The goal of IBS is to promote the safe and effective management of ships by skilled employees."

It is a distributed system that allows for the timeliness and reliability of multiple navigational equipment. IBS offers inertial sensors collecting and administration for a number of operations such as transit implementation, connectivity, apparatus management, and protection.

The IBS is a sort of navigator management platform that combines with other technologies to provide all ship navigating data in one place. It is important to remember that not every ship kinds have same kind of IBS. The method would vary based on the specifications of the boat's roof, the specialized equipment used by the ship, and the general layout of the bridge's gear.

The IBS platform supports at least two of the following features:

- Passage implementation
- Media
- Control of machinery
- Cargo transport

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- Ensuring the security

c. Advanced technologies and feasible remedies:

The following steps need to take care for enhancing the effectiveness of marine transports. The Fig.5. shows the numerous steps

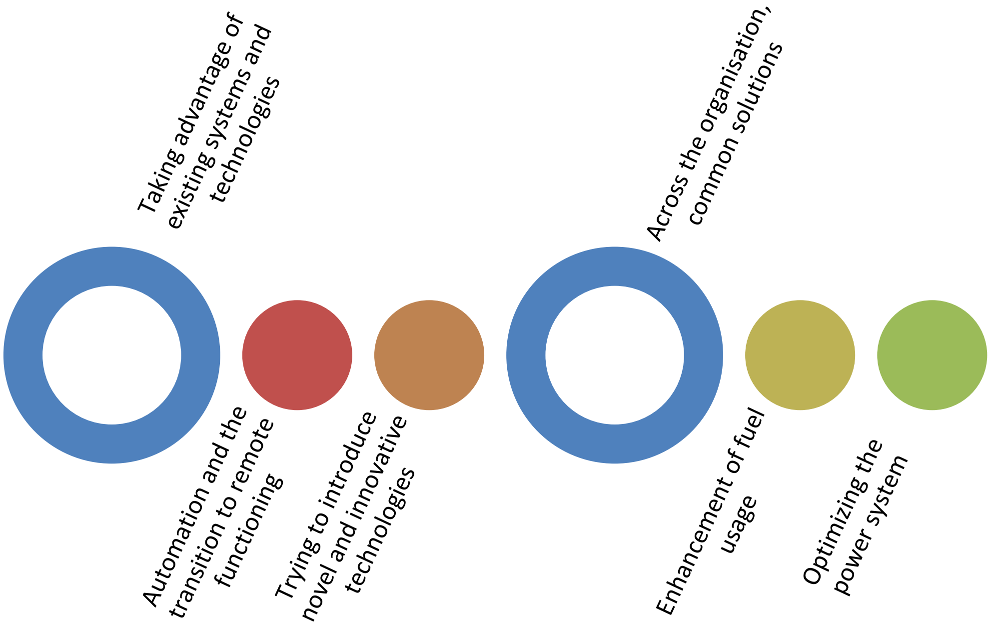

Fig 5. Advanced technologies and feasible remedies

The rising trends are the result of need. Shipbuilding, power, smart transportation, improve stuff, robots, and telecommunications advancements, along by an progressively trained staff, are all having a significant impact on how the marine sector approaches new problems and possibilities. . As per the Global Marine Technological Report 2030, major tech ecosystems will influence the future of merchant traffic, with substantial implications for ship construction and optimization.

❖ The first innovation arena emerges from inside the industry, as fierce rivalry pushes technological capability and production performance to achieve a competitive edge.

❖ The secondary generation of work comes from those other sectors, as developing technology exists to be transferred to ship systems is presented to improve safety and economic and monetary effectiveness.

The various technology are listed in Table.2.

Table 2. The modifications in the maritime industry to enhance its functionality

Shipbuilding	Design flexibility, efficient customization, waste reduction, and virtual inventory management will drive future construction technologies. Aside from product breakthroughs in organizational effectiveness, ecological impact is a primary motivator for implementing new shipbuilding technology.
Propulsion and Powering	Ship impulsion and power production will be major areas of technical advancement. It is not just the spectrum of relevant technology, which encompasses forthcoming technologies, substitute fuels, propulsive power strategies, hybrid power production, and pollution reduction technologies.

Smart Shipping	Today's concept of unpiloted equipment, as healthy as data-ambitious assistance such as vessel performance analysis and climate direction-finding, may be measured manifestations of the smart ship – the innovative smart ship will incorporate a variety of associated techniques to increase operational efficiency, ship managerial staff, compliance, judgement, environmental obligations, and also increase safety and servicing of vessel and crew through communications infrastructure.
Big Data and Analytics	Thanks to the help of communication technology, archived data may be stored aboard a ship or ashore. Moreover, AI abilities will serve as human data interpreters. These systems will mix machine learning technologies language understanding to provide a user-friendly interface between humans and machines.
Robotics	By 2030, there will still be 3 original types of robots being used. The first kind will be a teaching robot, the second one is a functional robot (manage an asset), and the third a micro, which will be helpful for inspections in difficult, dangerous conditions. Cognitive, versatile, imitation, sensing, and adaptability will be leveraged by these robotics.
Sensors	The use of sensors will significantly improve the efficiency and safety of boats and related devices. Sensors and the data they provide will hold also be in the corporate shipping industry. Real-time analysis and evaluation methods will be vital to the marine transportation industry's growth.
Communications	Ships nowadays create, gather, and transmit the ever quantity of statistics. Wireless telecommunications have been widely adopted for numerous centuries to provide real data transmission. Merely a few instances are marine very high frequency (VHF) facilities, satellites, and WiFi. Using a larger frequency range enables the sending of many messages at a quicker data transfer rate.

d. Energy-saving and improved performance:

Slow-speed operational planning, increased capacity and resource utilization, and accurate communication among shipping organizations for optimal route planning, another technique to improve ship efficiency is to reduce turnaround time in ports. The various steps for achieving the energy-saving scheme are presented in Fig.6.

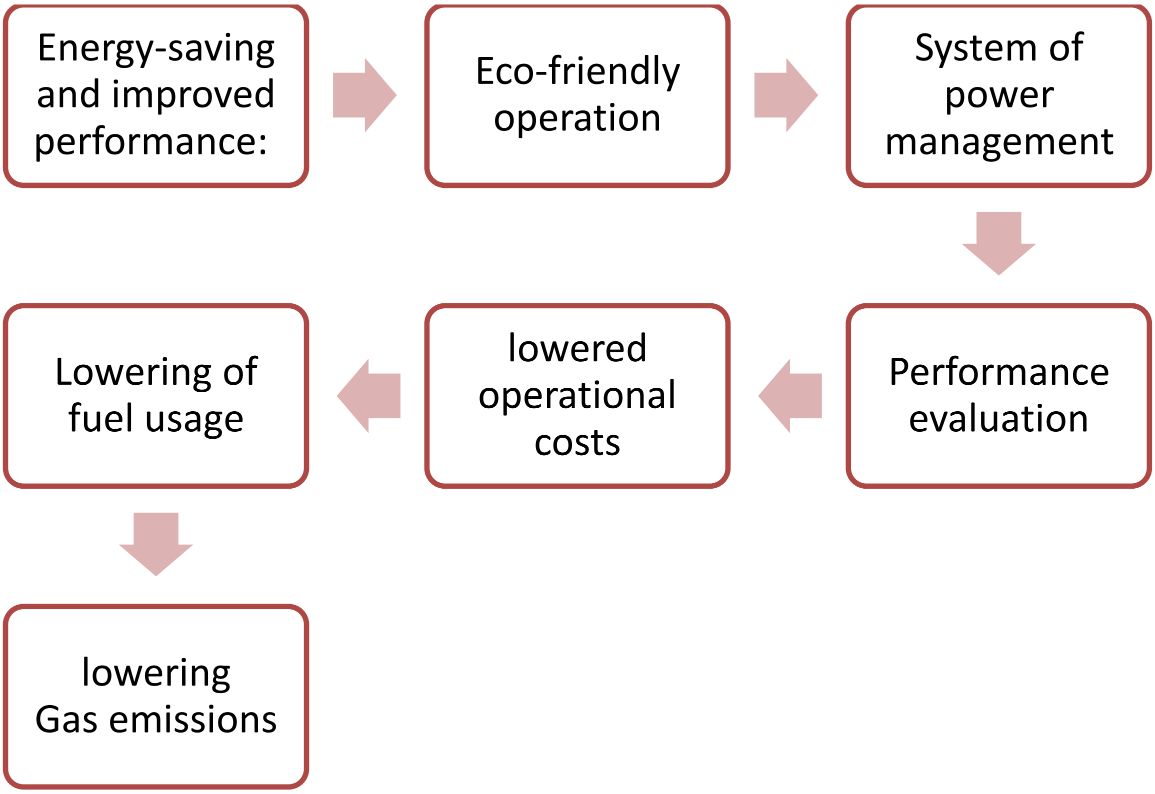

Fig 6. Energy-saving scheme

By adopting the various steps, the energy consumption can be reduced efficiently. Hence, the system efficacy is improved, with a lower amount of pollution.

V. CONCLUSION

This study offered an atomization of the Port Activity Application's in global trade. This section offers a summary of the planning and application of the Maritime Activity Application and the outcomes. The importance of the port sector in increasing economic growth is then explored, as is the influence of maritime transportation on the global economy. The Automation Methodology is next discussed, which consists of five parts (consider your current situation, investigate your future state, create a framework, accept data as a resource, and automation methodology). The automation process is then adopted. This process includes four sub-stages: "Management, assets, and functionality", IT and system assimilation, Advanced technologies and feasible remedies, energy-saving, and improved performance. By accommodating these issues, a great enhancement in losses can be observed. Hence the cost of fuel and pollution can be efficiently lowered. The overall system can be more robust, functioning.

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