UNIVERSITY OF PIRAEUS

DEPARTMENT OF MARITIME STUDIES

MASTER OF SCIENCE

IN SHIPPING MANAGEMENT

DryBMS : A New Era in Dry Shipping and the Role of Human Element

By Capt. Dimitrios Chatzianastasiou

Master Thesis

Submitted to Department of Maritime Studies, University of Piraeus as part of the requirements for acquisition of Master of Science (MSc) In Shipping Management.

November 2023

COPYRIGHT ©

The person who prepares the Master Thesis bears the entire responsibility for determining the fair use of the material, which is defined on the basis of the following factors: the purpose and character of the use (commercial, non-profit or educational), the nature of the material used (part of the text, tables, figures, images or maps), the percentage and importance of the section, that it uses in relation to the whole text under copyright, and the possible consequences of such use on the market or on the overall value of the copyrighted text.

DECLARATION OF AUTHENTICITY

I, the author of this Master Thesis, herewith declare that I wrote this thesis on my own and did not use any unnamed sources or aid. Thus, to the best of my knowledge and belief, this thesis contains no material previously published or written by another person except where due reference is made by correct citation. This includes any thoughts taken over directly or indirectly from printed books and articles and all kinds of online material. It also includes my own translations from sources in a different languages. The work contained in this thesis has not been previously submitted for examination. I also agree that the thesis may be tested for plagiarized content with the help of plagiarism software. I am aware that failure to comply with the rules of good scientific practice has grave consequences and may result in expulsion from the programme.

Three-Member Examination Committee

This Master Thesis was unanimously approved by the three-member Examination Committee appointed by the General Assembly of the Department of Maritime Studies of the University of Piraeus in accordance with the Rules of Procedure of the Postgraduate Program in Maritime Management.

The members of the Committee were:

- Angelos Pantouvakis (Supervisor)

- Meintanis Stavros

- Artikis Alexandros

The approval of the Diploma Thesis by the Department of Maritime Studies of the University of Piraeus does not imply acceptance of the author's opinions.

Abstract

The objective of this study was to examine the perspectives of shipping industry employees regarding the DryBMS, focusing on both the implementation obstacles and the associated benefits. Furthermore, an examination was conducted to determine the potential influence of individuals' present positions within the dry shipping sector on their perspectives regarding the future significance of DryBMS. Finally, the study centered on examining the impact of the training provided by organizations in DryBMS on employees' perceptions regarding the primary advantages and challenges associated with the deployment of DryBMS. The study undertaken involved a quantitative research approach, focusing on a sample of 120 participants employed within the shipping business. Based on the findings, it is evident that ship owners and operators tend to hold the perspective that the DryBMS business will exhibit a reasonably stable trajectory in the future. Conversely, ship managers exhibit a greater inclination towards the belief that the sector would witness a broader adoption. The majority of crew members, marine regulators, and individuals who identify their function in the shipping industry as "Other" express their support for the notion that the DryBMS will undergo further development in order to effectively tackle emerging difficulties in the future. In the meanwhile, a prevailing viewpoint among port authorities is that DryBMS is poised to undergo further development in order to effectively tackle emerging difficulties, or alternatively, it may experience a diminished level of relevance. In relation to the second research question, it appears that participants who got training and instruction from their respective organizations regarding the DryBMS predominantly hold the belief that its adoption has enhanced efficiency while encountering challenges stemming from resistance to change. Regarding those who did not undergo DryBMS training provided by their respective organizations, a significant majority of them express the belief that the introduction of DryBMS has resulted in a decline in safety standards and has encountered additional obstacles beyond those outlined in the research.

Key words: Dry BMS, crew, management, human resources, dry shipping

Contents

Introduction

In January 2021, RightShip and INTERCARGO together introduced DryBMS, a novel quality standard specifically designed for the dry bulk industry. The establishment of a new non-governmental organization (NGO) later this year oversaw the governance of the standard, aiming to enhance safety within the dry bulk sector. In August 2020, the two groups collaborated to consolidate their respective skills and establish a unified framework for the whole industry. DryBMS is a newly established framework, endorsed by the International Chamber of Shipping (ICS) and BIMCO, which comprises a concise compilation of optimal procedures and essential metrics. Its primary objective is to enhance standards in terms of safety, environmental consciousness, and operational proficiency within the maritime industry. The DryBMS is a self-regulatory framework designed for the dry bulk shipping industry. Its adoption and reporting are voluntary, and it does not impact the risk assessment provided by Rightship's star system. DryBMS is an elective standard that places emphasis on enhancing standards within the dry bulk maritime industry. The voluntary program aims to enable ship managers to assess the effectiveness of their Safety Management System (SMS) in accordance with established industry benchmarks. The ultimate goal is to enhance fleet performance and mitigate risks. This will ensure that the policies of an operator are in line with industry best practices, thereby enhancing their performance and achieving high standards in terms of health, safety, security, and pollution avoidance. The guidelines place emphasis on 30 specific aspects of managerial practice within the realm of vessel operations, encompassing four key risk domains: performance, personnel, infrastructure, and procedures (SQE, 2021).

The primary objective of this study is to examine the perspectives of shipping personnel regarding the DryBMS, including the obstacles encountered during its deployment as well as the advantages it offers. Furthermore, an examination is being conducted to determine the potential influence of individuals' existing positions within the dry shipping business on their perspectives of the future significance of DryBMS. Lastly, this research centers on examining the impact of the training provided by organizations in DryBMS on employees' perspectives of the primary advantages and challenges associated with the deployment of DryBMS.The research is structured in five chapters. The first three chapters contain the theoretical part of the paper. This is followed by the methodology and then the results of the statistical analysis carried out are presented. The paper concludes with the discussion and conclusions.

Chapter 1: Dry Shipping Industry Overview

1.1.Historical Perspective

Dry shipping is widely regarded as the most reliable and widely utilized method of transporting goods. Dry shipments are often transported in an enclosed trailer, as opposed to flatbed shipments which are openly exposed on the back of a vehicle. The inclusion of an enclosed trailer compartment in dry shipment renders it remarkably adaptable for a wide range of products. Pallets or boxes have the capacity to accommodate a diverse range of units, which can afterwards be arranged in vertical stacks and transported for shipment. Dry shipments are frequently employed for the transportation of various goods, including textile and garment items, as well as non-perishable food and beverage products (Redwood, 2017).

Due to the widespread use of dry shipment as a prevalent mode of transportation, there exists a substantial abundance of dry trucks and trailers on the market. This implies that they possess a certain degree of flexibility in accommodating your scheduling and geographical requirements. Additionally, these items are often available in large quantities, resulting in a generally lower cost compared to alternative methods of transportation. Additionally, the use of an enclosed trailer serves as a protective measure against adverse weather conditions and any theft incidents. This feature serves to safeguard cargo from various environmental factors, thereby enabling these vehicles to traverse the entire country without any apprehension.The loading and unloading process of dry shipments is facilitated by the utilization of a "drop and hook" load mechanism, which is characterized by its simplicity and ease of operation. This implies that drivers have the ability to conveniently detach an unladen trailer and afterwards attach a pre-loaded one. This practice results in a reduction of time, energy, and financial resources expended on the loading and congestion experienced at hubs (Chistè& Van Vuuren, 2014).

The emergence of dry bulk shipping can be attributed to the necessity of minimizing transportation expenses as the volume of commodities being shipped grew to a point where they could be transported in large quantities, allowing for the utilization of economies of scale. The historical context of this phenomenon may be traced back to the nineteenth century, during which small wooden vessels were utilized to fulfill the growing need for coal transportation between North England and London. In contemporary times, there has been a notable rise in the quantity of goods transported via a "one ship, one cargo" approach. This can be attributed to global economic expansion, heightened requirements for essential resources and energy commodities, the liberalization of international trade, the

internationalization of industrial operations, and advancements in shipbuilding and design technologies. The increase in global trade resulted in a commensurate growth of the bulk shipping fleet in order to meet the demands of maritime bulk trade (Alizadeh & Nomikos, 2013).

Extensive scholarly inquiry in the field of economic history has been dedicated to the examination of the significant reduction in transportation costs during the 18th and 19th centuries, alongside the identification of the underlying catalysts that propelled this transformative revolution in transportation. Mohammad and Williamson (2004) make a significant scholarly contribution by providing an extensive examination of maritime transportation expenses throughout the crucial timeframe spanning from 1869 to 1950. Through their analysis, they have identified noteworthy levels of productivity growth within the shipping sector over a span of 80 years. Furthermore, they have observed that this productivity growth is significantly influenced by substantial alterations in ship cargo capacities/sizes and turnaround times in ports. O'Rourke and Williamson's influential research on the global economy before to World War I (1999) highlights the significant role played by the decrease in ocean transportation costs and the widespread adoption of railways in elucidating the onset of the initial wave of globalization starting in 1870. In addition to the examination of gradual changes in freight rates, scholarly discourse has consistently posited the presence of cyclical periods of prosperity and decline within the maritime transport sector (Stopford, 2009). Furthermore, an increasing body of scholarly research in the fields of behavioural finance and industrial organization has embraced similar assertions, recognizing that this cyclical pattern of growth and decline significantly contributes to comprehending the intricacies of ship construction, ship profitability, and ship valuations within the dry bulk industry. The primary underlying mechanism explored in these works is to the influence of unforeseen positive shocks in shipping demand and their subsequent transmission throughout time. Following significant disruptions, the subsequent increases in maritime freight rates result in excessive investment in shipping supply. This can be attributed to limitations in the time required for construction, or to firms simultaneously overestimating future freight rates and underestimating their competitors' reactions(Jacks &Stuermer, 2021).

1.2.Current Market Trends

The maritime sector is subject to continuous transformation, and staying abreast of industry developments is crucial for optimizing business results. In order to successfully monitor significant developments in the dry bulk shipping markets and make meaningful predictions,

it is imperative to include market information into the commercial workflow. According to the International Monetary Fund (IMF), there is an estimated global economic growth of 2.9% in the Dry Bulk Shipping sector for the year 2023, followed by a projected increase of 3.1% in 2024. The projected growth rate of the Chinese economy for the year 2023 has been revised upwards by 0.8 percentage points compared to the previous forecast made by the International Monetary Fund (IMF). It is now anticipated to expand by 5.2%.The projected increase in demand for the year 2023 is anticipated to fall within the range of 1.5% to 2.5%, mostly influenced by the ongoing economic revival in China. Enhancements in consumer sentiment are expected to play a pivotal role in addressing the nation's real estate problem and stimulating overall demand (Dæhli Priess, 2023).

Nevertheless, it is anticipated that the growth in demand may see a decline to a range of 1-2% by the year 2024, primarily attributed to the projected decrease in the transportation of coal. The demand for imports is expected to decrease due to the efforts of India and China in promoting domestic mining, as well as Europe's shift towards alternative energy sources, hence reducing reliance on fossil fuels. According to projections, there is an anticipated growth of 2.7% in the dry bulk fleet for the year 2023, followed by a growth of 2.0% in the subsequent year, 2024. The current state of deliveries is characterized by limitations due to a tiny orderbook, which accounts for only 7.5% of the total fleet.According to projections, the anticipated growth of supply in the years 2023 and 2024 is expected to be 0.5-1.5% lower than that of the fleet. This decrease can be attributed to reduced speeds resulting from adherence to the Energy Efficiency Existing Ship Index (EEXI) and Carbon Intensity Indicator (CII) standards.It is anticipated that the equilibrium between supply and demand will experience a positive shift in 2023; nevertheless, it is important to note that potential hazards are expected to persist in 2024. Also, there would be a resurgence in rates as the demand for goods and services in China experiences an upturn. The potential for a rebound in iron ore demand is expected to positively impact the performance of Capesize vessels, but the vulnerability of Panamax ships lies in their susceptibility to a decline in coal exports (Rasmussen, 2023).

It is anticipated that there would be a little increase in grain volumes in the years 2023 and 2024. The commencement of the conflict in Ukraine has exerted significant strain on the availability of wheat and maize, necessitating exporters to utilize their existing stockpiles. Furthermore, the occurrence of drought has adversely impacted the agricultural yields in prominent exporting nations like the United States and Argentina. In anticipation of future

trends, the United States Department of Agriculture (USDA) projects a decrease of 0.2% in wheat exports for the upcoming 2023/24 marketing year, followed by a subsequent gain of 1.7% in the subsequent 2024/25 period. The current marketing year may witness a decline of 9.8% in maize exports, followed by a subsequent recovery and an increase of 3.9% in 2023/24, and a further rise of 1.9% in 2024/25. Nevertheless, this measure alone will not suffice to restore volumes to their pre-war levels. The projection provided by the United States Department of Agriculture (USDA) does not incorporate a specific timeline for the conclusion of the conflict in Ukraine, thereby neglecting to factor in the potential recovery of Ukraine's agricultural production (Dæhli Priess, 2023).

The projected forecast for soybeans is characterized by a higher degree of optimism, as it is anticipated that volumes will see a notable increase of 9.5% during the ongoing marketing year. Furthermore, it is expected that this positive trend will continue in subsequent years, with estimated growth of 1.8% in 2023/24 and 2.1% in 2024/25. According to the United States Department of Agriculture (USDA), the projected rise in quantities can be attributed to greater harvests in Brazil. Conversely, the USDA anticipates that exports from the United States will remain consistent due to the constraints imposed by increasing domestic demand for biofuel production, which limits the potential for export growth (Janzen, 2023).

In contrast to previous years, it is anticipated that there would not be a higher rate of growth for minor bulk commodities compared to large bulk commodities in the year 2023. The volumes have exhibited a downward trend subsequent to the latter half of 2022, with a notable decrease of 7.1% year-on-year during the initial two months of 2023. The anticipation of China's economic recovery is projected to stimulate an increase in demand for certain commodities. However, the rebound may be constrained due to the prevailing unfavorable market circumstances in advanced nations. In contrast to larger quantities, advanced economies play a significant role in stimulating demand and contribute to 37.5% of minor bulks tonne miles. It is posited that there may be a potential for an improvement in demand by the year 2024, coinciding with the stabilization of the global economy.

Despite the presence of an enhanced perspective for worldwide bulk demand, many dangers persist, and there exists the possibility of a more unfavorable scenario unfolding. The potential impact of a prolonged recuperation of the Chinese economy on the performance of the bulk industry in 2023 should not be underestimated. China continues to face the persistent challenge of its protracted real estate crisis, necessitating the implementation of government

stimulus measures to facilitate the acceleration of economic activity. Despite prior government action, housing developers have not yet fulfilled a substantial backlog of presold housing units, and the level of real estate investment remains insufficient. This situation has the potential to impede the recovery process (Dai et al., 2023).

There are also other concerns pertaining to bulk commodities that could potentially impact demand. The continuing deliberations regarding the continuation of Ukraine's grain agreement possess the capacity to impede supplies as early as March 2023. Furthermore, it is worth noting that the occurrence of severe weather phenomena, such as the droughts experienced by numerous grain-exporting nations in the year 2022, has the potential to exacerbate the existing limitations on world grain reserves. However, it is important to note that persistent elevated energy prices may present a potential positive risk to our projected outlook. In the event that oil and gas prices remain elevated, economies in Asia and Africa that are most susceptible to price fluctuations may persist in perceiving coal as a cost-effective energy option, thereby prolonging the process of phasing out this resource (Rasmussen, 2023).

1.3.Key Players and Stakeholders

According to Dry Bulk Shipping Market Report Insights the top Key Players in the field of dry shipping for the year 2020werw the companies: Masterbulk, Marine Services Company Limited, D/S Norden, Wilson (company), Belships, Dry Ship, Inc., Genco Shipping&Trading, Diana Shipping, Westfal-Larsen, Pacific Basin, Scorpio Bulkers, Marquette Transportation Company, Golden Ocean, Western Bulk, B+H Ocean Carriers, Star Bulk Carriers Corp, Camillo Eitzen & Co (Market research experts, 2023).

The primary stakeholders involved in the maritime sector are:

The Ship Owner, which refers to the entity or organization that possesses ownership of a maritime vessel, commonly known as a ship. Ship owners allocate their capital, either independently or with the aid of financial institutions or private funds, towards the construction of new vessels (new structures) or the acquisition of pre-owned ships. The ship owner is tasked with the responsibility of making strategic decisions on the optimal timing, ship type, and size, as well as the appropriate purchase price. Additionally, the ship owner

must also undertake the crucial task of arranging suitable finance for the acquisition.Additional crucial determinations pertain to the functioning and technical administration of the vessel. Certain ship owners have established departments that are responsible for either technical or commercial operations. Many ship owners, particularly those with a small to medium-sized fleet of fewer than ten ships, sometimes opt to delegate the commercial and/or technical administration of their vessels to specialized businesses known as Ship Operators (for commercial management) and Ship administration companies (for technical management) (CompassAir, 2023).

Ship owners strive to generate financial gains through:

- Engaging in the practice of purchasing ships at a relatively low cost and subsequently selling them at a higher price, sometimes referred to as speculative investing, and
- The act of chartering the ship at advantageous freight rates.

The foremost nations in terms of ship ownership include Greece, China, Japan, Germany, Norway, Denmark, the United States, among others.

The second stakeholder is the Ship Operator which is the entity accountable for the process of chartering the vessel. The operator will be required to make the following decisions (CompassAir, 2023):

- determining the cargo order to fulfill and the corresponding freight rate.
- selecting from several chartering options, such as the alternatives of voyage excursions, time charter, bareboat charter, and contract of affreightment.
- choosing the location for refueling, commonly referred to as bunkering, together with the specific quantities of bunker fuel available and their corresponding rates.
- ascertaining optimal ship routes and cruise speeds, while also ensuring the maintenance of strategic positions. This will enable ships to be in close proximity to ports that offer lucrative opportunities for subsequent cargo orders.
- negotiating port expenses
- selecting port agents
- estimating and budgeting charges
- making payments

Ship operators frequently manage "pools" to oversee many vessels owned by various stakeholders, including those already under their jurisdiction. Ship owners mitigate the risk

associated with each individual ship by distributing the total benefits and drawbacks arising from the economic performance of all the ships within the pool. Nevertheless, ship owners possess the autonomy to withdraw from a pool at their discretion (Branch, 2012).

A Ship Management business, which is the third stakeholder assumes primary responsibility for crewing, technical upkeep, and the provision of meals and spare components. Ships can be seen as costly assets that experience depreciation over time and necessitate meticulous upkeep of superior quality. Ensuring the high quality and safe delivery of goods is generally imperative for attaining better freight rates, necessitating the implementation of proper maintenance practices. The upkeep of ships is mostly regulated by specialized engineering firms, commonly referred to as Classification Societies or Classes.Every vessel is assigned to a specific classification, which entails a comprehensive set of duties that must be meticulously executed in order to guarantee the adequate upkeep and navigability of the ship. Non-adherence to the prescribed maintenance regimen can result in non-conformities that have the potential to compromise the ship's seaworthiness. There exists an estimated global count of roughly 1500 ship management businesses that are responsible for the management of a minimum of 10 ships or more. The United Kingdom, Singapore, Cyprus, Hong Kong, and several more nations are home to the most prominent ship management companies (Lun et al., 2012).

A charterer, the fourth stakeholder, refers to the corporate entity that assumes the role of representing the cargo owner, although in certain instances, the charterer may also be the actual owner of the cargo. The primary objective of the Charterer is to efficiently carry products from port A to port B, prioritizing cost minimization while simultaneously upholding the utmost standards of transportation quality and safety. This delicate balance between cost and quality is of great significance. The Charterer is required to assess and ascertain the most suitable charter type for each specific occasion, such as journey excursions, time charter, COA, among others. Additionally, the Charterer must make informed decisions regarding the selection of loading and discharge locations, appointing port agents, estimating budgets, and determining refueling destinations, among other related considerations. The most prominent charterers are headquartered in Switzerland, the United Kingdom, Germany, the United States, and Singapore. It is a regular practice for Charterers to possess and oversee their own fleet, and in certain instances, they may even lease out a portion of their own vessels (CompassAir, 2023).

A Chartering Broker, the fifth stakeholder, assumes the intermediary function in facilitating the process of chartering ships. Chartering brokers possess an extensive network of ship owners/operators and charterers/cargo owners, enabling them to effectively match and suggest suitable ships for cargo orders. Chartering brokers levy a commission on the ultimate agreed-upon total freight rate between the parties involved in the shipment, namely the ship and cargo stakeholders. The United Kingdom is home to the most prominent shipbroking enterprises. Greece, Germany, Singapore, Norway, and the United States are among the countries that have a significant concentration of shipbrokers (Olesen, 2015).

The Sale & Purchase (S&P) Broker, the sixth stakeholder assumes the intermediate function in facilitating the transactional process of ship acquisition and disposal. Similar to chartering brokers, S&P brokers establish extensive networks comprising ship owners and banks to effectively uncover suitable matches and advantageous prospects for ship sales and purchases.

Chartering and S&P brokers play a significant role as data powerhouses within the maritime sector. Prominent shipbroking firms, including Clarksons, Simpson Spencer Young (SSY), Howe Robinson, and McQuilling, produce both standardized and customized research reports for their clientele. Additionally, a significant number of individuals engage in the production and dissemination of complimentary newsletters and reports, which encompass their personal commentaries and analyses pertaining to prevailing market conditions (CompassAir, 2023).

Two further prominent sources of marine information include IHS MarkIT and the Lloyd's List marine Intelligence Unit (LLMIU). The primary emphasis lies on the acquisition and analysis of an extensive range of maritime data, encompassing vessel technical and commercial information, chartering data, Automatic Identification System (AIS) data, and other pertinent sources. Additionally, the scope extends to encompass financial, business, and trade news pertaining to the marine industry. Additional renowned maritime shipping and commodity research businesses encompass Drewry, S&P Global Platts, and various more entities (Cariou & Wolff, 2011).

Financial institutions, such as banks and individual investors, are the sixth stakeholders that have to be mentioned, because they provide loans to ship owners for the purpose of acquiring vessels. The percentage of ship financing exhibits significant variability, contingent upon prevailing conditions within the shipping market. In instances of very favorable market conditions, it is plausible for ship financing to escalate to as high as 80%. Financial

institutions have the authority to seize vessels from their owners in the event of a loan agreement violation. In instances of this nature, a financial institution may assume the role of a ship proprietor for a designated duration. Over the past decade, numerous private funds have made their foray into the maritime sector, offering financial resources for the construction or acquisition of commercial fleets. These privately held funds have the potential to either remain privately held or facilitate the company's transition to an initial public offering (IPO) or an alternate exit strategy (Chistè& Van Vuuren, 2014).

Classification societies, the seventh stakeholders, often known as classes, are independent entities that are not affiliated with any government. Their primary purpose is to create and uphold technical criteria for the design, construction, and operation of ships and offshore structures. Certification is offered for both the building and continuous servicing of vessels, serving as a verification that the vessel complies with the necessary criteria. Presently, the number of classification societies exceeds 50, with notable examples including Lloyds Register (UK), Bureau Veritas (France), and DNV GL (Norway/Germany).

Shipyards, the eighth stakefolders, construct vessels according to the mutually approved designs established by the ship owner and the engineers employed at the shipyard. Shipyards have the potential to get financial subsidies or establish partnerships with banks in order to extend attractive proposals to ship owners for the construction of new vessels. A significant majority, exceeding 90%, of the merchant fleet is constructed inside the shipbuilding industries of China, Japan, and South Korea. Norway, Germany, and Italy are home to specialized shipyards that cater to the construction of offshore and passenger vessels (CompassAir, 2023).

Demolition yards, which are the next stakeholders mentionted often referred to as shipbreakers or ship recyclers, have the responsibility of dismantling vessels that their owners have chosen to retire from active service, typically due to factors such as age or other considerations. In instances of highly unfavorable market conditions, even relatively recent vessels, ranging from 5 to 10 years old, may have financial challenges and consequently be disposed of as scrap. The primary determinants to consider when evaluating the demolition of a ship are the prevailing freight costs in relation to the scrap value of the vessel, with the latter being mostly influenced by the existing steel prices. The majority of demolition yards are situated in India, Bangladesh, China, Pakistan, and Turkey (CompassAir, 2023).

Traders and Hedge Funds, which ore other important stakeholders, are frequently found within the organizational structure of ship operators, commodities traders, and ship owners. Alternatively, they may exist as independent entities, such as commodities Trading Desks within investment banks, macro hedge funds, or commodity-specific hedge funds, which do not engage in physical shipping. There are a few Freight exchange-traded funds (ETFs) available, such as Invesco and Breakway Dry Bulk. The individuals involved in this study will engage in the active trading of both dry and wet freight, employing similar strategies as those used in the trading of oil or equities. In general, their operations mostly involve transactions related to derivatives, specifically focusing on futures and swaps (CompassAir, 2023).

Trading strategies may generally be categorized into two types: directional strategies and time/product spreads. Directional strategies involve taking positions based on the expected movement of a specific commodity or market. On the other hand, time/product spreads focus on the price difference between different types of commodities, such as Capes and Panamaxes in the dry bulk industry. Additionally, trading strategies can also be part of broader structures that involve underlying commodities, such as coal and grains. The aforementioned participants will moreover offer hedging liquidity to physical market participants who choose to mitigate their price risk exposure through the utilization of swaps or options (Heij et al., 2011).

A port or terminal, the last important stakeholder serves as the designated location for the loading and unloading of commodities. Ports are typically situated in close proximity to important inland transportation networks in order to enhance the efficiency of cargo transportation. Ports exhibit significant variations in terms of their dimensions, capacity to accept ships of varying sizes, capabilities for hinterland transportation, equipment for loading and unloading cargo (such as cranes and container lifts), employment of planning and optimization technologies, efficiency of customs operations, and the presence of bureaucratic obstacles (Song &Panayides, 2012).

Some of the major ports throughout the world include Rotterdam, Antwerp, Amsterdam, Hamburg, Singapore, Shanghai, Tianjin, Guangzhou, Ningbo, Suzhou, Qingdao, Dalian, Busan, Hong Kong, Klang, Kandla, Jawaharlal Nehru, Hedland, Houston, South Louisiana, Dubai, and several others. Offshore oil terminals are maritime installations designed to facilitate the loading and discharging operations for large vessels. These terminals are

strategically positioned away from the shore to accommodate the servicing of sizable ships. For instance, the LOOPS terminal in Louisiana, USA serves as an illustrative example of such a facility (CompassAir, 2023).

Chapter 2: Technological Advancements in Dry Shipping

2.1.Automation and Robotics

Dry docking is an essential component of nautical operations, with a long-standing history spanning several centuries. It involves removing a ship from the water and placing it on a dry dock to carry out maintenance, repairs, or upgrades (House, 2015). Over the course of time, the practice of dry docking has seen advancements, with technology playing a pivotal part in enhancing the efficiency of the procedure.Historically, the procedure of dry docking entailed a labor-intensive and time-consuming physical operation. The vessel was extracted from the aquatic environment through the utilization of ropes and winches, thereafter undergoing necessary repairs and maintenance procedures while situated on the dock. The procedure was characterized by a high demand for manual labor, a significant investment of time, and frequently led to inaccuracies and setbacks(Noatum, 2023).

The introduction of technology has resulted in increased efficiency, accuracy, and cost-effectiveness in dry docking operations. The implementation of computer-aided design (CAD) systems has facilitated ship designers in generating comprehensive blueprints and designs, resulting in enhanced efficiency of the dry-docking procedure. Additionally, these systems possess the capability to forecast the allocation of load and identify areas of high stress within the ship. These elements play a pivotal role in assessing the stability of the vessel throughout the dry-docking procedure.One significant technological progression in the field of dry docking is to the implementation of automation and robotics. The utilization of automated technology has facilitated the efficient execution of several manual operations associated with dry docking, including welding and painting. Robotic systems possess the capability to execute meticulous and repetitive operations, so mitigating the potential for human fallibility and augmenting the efficiency of the dry-docking procedure(Noatum, 2023).

Sensors and data analytics also play a crucial role in the field of dry docking (Raptodimos et al., 2016). Sensors have the capability to continuously monitor the state of the ship and promptly identify any possible concerns, such as corrosion or mechanical deterioration, in a live operational setting. The aforementioned data can then undergo analysis through the utilization of data analytics technologies, facilitating the identification of prevailing trends and patterns, hence enhancing the efficacy of dry docking operations.The utilization of technology has been of utmost importance in the advancement of dry-docking procedures. It has resulted in enhanced efficiency, accuracy, and cost-efficiency, while concurrently

enhancing safety measures and mitigating the likelihood of errors and delays. With the ongoing advancement of technology, it is certain that dry docking procedures will undergo further evolution, leading to enhanced efficiency and optimization in the future (Noatum, 2023).

2.2.Internet of Things (IoT) Integration

The domain of shipping is increasingly becoming characterized by the pervasive implementation of automation and digitization. Vessels worldwide are being outfitted with cutting-edge electronics, sensors, and software solutions. The primary focus is on achieving cost reductions and enhancing efficiency.The rate at which sensor technologies are being implemented is seeing significant growth, resulting in many technological and regulatory obstacles. The utilization of affordable computer components will present a plethora of possibilities for both industrial and research endeavors. The devices will possess the capability to function inside a network that is interconnected with a distant device, hence facilitating the gathering and analysis of data. The imminent advancements in wireless sensor technology and the emergence of novel micro- and nanomechanical sensors are poised to bring about transformative shifts in the field of environmental monitoring and data collection(Marine Digital, 2023).

The process of automating charts is quite uncomplicated in relation to the automation of traffic or aviation systems. In contrast to vehicular traffic, maritime traffic is characterized by significantly lower levels of congestion. Nevertheless, the situation in global ports presents a contrasting scenario. A significant number of individuals depend on the use of remote control devices in this context. However, it is worth noting that there are other automated docking technologies available. SmartDock is a system that has been developed by Wärtsilä (Pirozhnikov&Schaminee, 2023), a prominent Finnish technology company(Narendan et al., 2015).

The need for frequent visits to far sites for data uploading or sample collection will be obviated, as data will be autonomously gathered through the deployment of a network of remote sensors that possess the ability to communicate and transmit data instantaneously. In order to establish a resilient wireless networking framework suitable for the shipping industry, it is imperative to employ sensors that possess several key attributes. These attributes include self-calibration capabilities, fault tolerance, high transmission capabilities, wireless functionality, utilization of environmentally friendly materials for convenient

disposal, robustness, ultra-low energy consumption, miniaturization, capacity to exhibit active behavior, and compatibility with network modules employing master-slave layouts. The equipment present on board, both vital and non-essential, will possess the capability to monitor, manage, and control its operational state. In addition, the device will include the capability to alert operators in advance of depleting circulating liquids or the need for maintenance. There will be an enhancement in the monitoring of conditions. Sensors play a crucial role in monitoring and managing assets by employing an early warning strategy and enhancing operations and maintenance processes(Marine Digital, 2023). The enhancement of data quality will experience exponential growth, and the acquisition of data from sensors will be highly regarded from a legal standpoint. The advancement of sensor technology will play a crucial role in facilitating the progress of other domains, including smart ship technology, big data analytics, and robots. The operational lifespan of the equipment will be prolonged. This will have an impact on the associated capital expenditure (CAPEX). The utilization of this technology will provide the close monitoring of the asset throughout its lifespan, hence enhancing its financial performance (Zaman et al., 2017). Finally, it should be noted that touch technology presents a cost-effective alternative for widespread acceptance in the general population. The database will be unable of accurately tracking the current values of the entities and will instead rely on outdated values. Queries utilizing these outdated values will yield inaccurate results. Nevertheless, when the level of uncertainty between the true data value and the value stored in the database is constrained, the responses to queries will exhibit greater reliability(Marine Digital, 2023).

The presence of ambiguous data in an application might lead to varying degrees of inaccuracies. The safeguarding of data network and data management systems in the shipping industry is of utmost importance due to their increasing significance. It is crucial to ensure that these systems are adequately safeguarded from external interference, particularly from threats such as viruses, piracy, and terrorist attacks. The occurrence of a potential cyberattack (Ben Farah et al., 2022) on a sensor network has the capacity to inflict significant harm upon the business, resulting in the disruption of operational processes and the malfunctioning of critical systems and equipment. The utilization of sensors presents a promising prospect for enhancing the efficacy and security of ships and associated apparatus. The sensors and the data they gather possess significant potential within the realm of commercial shipping. The use of real-time monitoring and analysis methodologies is crucial for enhancing the efficiency and effectiveness of the commercial shipping industry. The acquisition of accurate

and dependable ship data through the utilization of reliable sensors will introduce novel avenues for optimizing the lifespan of ships. One outcome will be the potential to prolong the vessel's life cycle in accordance with the most stringent operational standards(Marine Digital, 2023).

This technology will generate data that need appropriate procedures for its transfer, storage, and analysis (Zaman et al., 2017). Additionally, it will enhance the efficiency and upkeep of maritime vessels and their accompanying equipment throughout their lifespan. Over time, there will be a gradual transition towards the adoption of sensors that possess stable features, capable of withstanding external disturbances such as vibrations, extreme temperatures, and noise. The incorporation of neural networks into industrial control systems that rely on wireless communication channels is anticipated to contribute to the development of a certain degree of intelligence. When integrated with other technological advancements, the utilization of sensors will prove to be a highly effective instrument for the commercial shipping industry (Marine Digital, 2023).

2.3.Eco-Friendly Technologies

The shipping sector has been a fundamental component of global commerce for several centuries. The advent of shipping has brought about a significant transformation in our daily lives, as it has facilitated the transportation of commodities from many global locations to virtually any destination. The shipping sector has demonstrated a propensity for adjusting to contemporary circumstances and embracing technological innovations throughout its historical development. The shipping industry's ability to adapt has been important in its continued existence. However, the current issue confronting the sector may prove to be its most formidable challenge to date(Campbell, 2020).

As the global community increasingly acknowledges and responds to the imminent environmental problem, numerous institutions are compelled to embrace more sustainable operational practices. The shipping sector is not exempt from this imperative. The shipping industry is gradually embracing eco-friendly technologies, leading to a notable adaptation within the sector. Several green technologies are now influencing the transportation industry as we approach the year 2030 (Ben Ahmed et al., 2023). The practice of slow steaming refers to the deliberate reduction of vessel speed in maritime transportation.Slow steaming refers to the practice of running transoceanic vessels at speeds below their maximum capacity in order to minimize fuel consumption. The concept of slow steaming, which emerged in the maritime

sector in 2007, gained attention as a strategic response to escalating fuel expenses. Since the year 2007, the technique of slow steaming has become a customary procedure due to its cost-saving benefits and its potential to mitigate carbon emissions(Campbell, 2020).

In its most basic definition, ballast refers to a mass employed to maintain equilibrium in a waterborne vessel and guarantee that the ship's propellers remain submerged at all times. Ships that lack sufficient ballast are susceptible to tipping and perhaps capsizing when exposed to strong winds. Various forms of ballast exist, including "live ballast" or the mass of the crew, keels composed of high-density substances like lead or iron, and the utilization of water as ballast. Water ballast (Bradie et al., 2023) is considered the most environmentally problematic approach for stabilizing ships(Campbell, 2020).

Ships equipped with water ballast systems facilitate the intake of water into the vessel's hull, afterwards storing it at a location situated under the ship's vertical center of gravity. Water ballast ships typically intake water at the commencement of their voyage and afterwards discharge the water ballast upon reaching their intended port of call. The discharge of ballast water encompasses a diverse array of biological entities, including marine organisms, viruses, and microbes (Bradie et al., 2023). Although seemingly innocuous, the process of transferring water from one place to another can have significant environmental consequences. The introduction of non-native species into a previously unaffected ecosystem has the potential to disrupt its delicate balance and cause irreversible damage. A novel design for a bulk carrier cargo ship, devoid of water ballast, has been created as a proactive measure to mitigate the adverse environmental impacts associated with its usage. The newly implemented design facilitates a continuous flow of water through the ship, ensuring that the water entering the ship will exit within the same zone. By implementing this approach, the adverse environmental effects associated with water ballast are mitigated, while simultaneously ensuring that the ship's safety and efficiency remain uncompromised(Campbell, 2020).

The effectiveness of a ship is influenced by numerous aspects, and contemporary ship designers are continuously striving to achieve optimal design configurations.The utilization of advanced propellers and streamlined rudder systems in contemporary maritime technology has been shown to result in a reduction of fuel consumption by approximately 4%, concomitant with an enhancement in the overall velocity of the vessel. Certain vessels have included supplementary sail and kite propulsion mechanisms alongside conventional forms of propulsion. The incorporation of these environmentally-friendly propulsion technologies

results in a decrease in fuel consumption, as the vessel is no longer exclusively dependent on engine-driven propulsion(Campbell, 2020).

The frictional resistance of a ship is influenced by the application of hull paint. The utilization of anti-fouling paint, which inhibits the accumulation of marine organisms, can lead to a reduction in fuel consumption by around 3-8%. Historically, ship hulls have exhibited a rounded form, which has been found to be suboptimal in terms of hydrodynamic efficiency when navigating across water (Psaraftis&Lagouvardou, 2023). Contemporary ship designs are employing improved hull forms in order to enhance ship velocity while concurrently minimizing fuel consumption.Contemporary designs incorporate an air cushion beneath the hull, so mitigating friction and resulting in fuel conservation.The prevailing belief among individuals is that the primary source of pollution from the shipping sector is the discharge of fuel. However, it is important to acknowledge that the process of ship disposal also generates a substantial quantity of garbage. The inadequate disposal of ships has led to the emergence of ship graveyards worldwide, where vessels that have reached the end of their operational lifespan are deliberately destroyed and left abandoned. In recent times, shipbreaking has emerged as a more widely acknowledged technique of disposal, involving the dismantling of ships. However, it is important to note that this procedure is not without its limitations. The practice of shipbreaking has led to the disposal of hazardous substances, including asbestos, in unutilized regions. Additionally, several firms opt to transfer their decommissioned vessels to developing nations, afterwards dumping them for local communities to demolish(Campbell, 2020).

Fortunately, the practice of green ship recycling has been introduced (Zainol et al., 2023). The conversion of reusable and precious ship components, such as steel, brass, and silver, into materials suitable for utilization in other contexts is undertaken. The salvageable components of a decommissioned vessel, including as light fittings, batteries, and generators, have the potential to be repurposed and utilized on a new vessel or terrestrial setting. The proper containment and removal of hazardous materials is diligently executed, with contemporary shipbreaking dry-docks effectively achieving a 99% success rate in the disposal of such substances. The establishment of green ship recycling dry-docks not only contributes to the promotion of environmental sustainability in the maritime sector, but also facilitates the generation of additional employment opportunities that align with the objectives of the environmentally conscious maritime movement.The shipping sector is gradually undergoing a process of adaptation and transitioning towards greater environmental

sustainability. The implementation of novel environmentally-friendly technology and designs in the shipping industry enables the continued transportation of global commodities, while concurrently mitigating adverse ecological consequences (Campbell, 2020).

Dry bulk carriers are a significant component of the maritime industry, accounting for more than one-fifth of the worldwide merchant fleet. Commonly seen as vessels with less complex equipment, these ships are now required to adhere to more stringent efficiency and environmental regulations, similar to other types of ships. This is done to reduce the consumption of fossil fuels and mitigate greenhouse gas emissions (Alamoush et al., 2022).The role of class in this transformation road is becoming increasingly significant. Class not only serves its conventional job of ensuring safety but also acts as a reliable consultant in areas like as technology, alternative fuels, performance optimization, and sustainability (Kakalis, 2023).

From a market perspective, the dry bulk sector is currently experiencing a period of sustained growth following a period of decline in previous years. This positive trend is expected to persist over the next few years. The sentiment is positive and the underlying principles of supply and demand appear to be advantageous. The majority of prominent commodities, including coal, grain, and minor bulks, are projected to experience growth, while the iron ore market is anticipated to remain relatively constant. Although the previous year witnessed a significant surge in the sale and acquisition of pre-owned bulk carriers, marking the most robust performance in ten years, the worldwide inventory of newly constructed vessels continues to exhibit a limited volume of orders. One contributing factor to this situation is the prevalence of high costs, which can be attributed to the substantial occupancy of large yards, primarily by container boats.One additional factor is the hesitancy exhibited by owners of dry bulk vessels in initiating new construction orders. This hesitancy stems from the persistent ambiguity around the available fuel and technology alternatives that would ensure compliance with existing and forthcoming regulations pertaining to decarbonisation. The examination of an ideal combination of fuel and technology on ships, taking into account their dimensions and projected trading activities, in order to ensure adherence to regulations over the long-term investment period or vessel lifespan, is a crucial subject that requires attention (Kakalis, 2023).

Chapter 3:Human Elementand Management in Dry Shipping

3.1.Management in Dry Shipping

Shipping management refers to the systematic coordination and oversight of various activities involved in the transportation of goods, raw materials, freight, equipment, or supplies. These activities encompass a range of tasks such as sorting, weighing, handling, packaging, inventory management, warehousing, transportation, distribution, security measures, compliance checks, and the management of data for the purpose of recordkeeping. The process encompasses a sequence of tasks, which entail the collection of merchandise from store shelves and the packaging of various products, such as stage packages, in preparation for shipment pickups. Shipping management refers to the comprehensive process of planning, preparing, and executing the transportation of shipments, with the ultimate goal of ensuring their successful delivery to retail establishments, customers' addresses, or designated destinations. The primary objective of shipping management is to enhance sales by optimizing warehouse efficiency, expediting order processing, and rationalizing inventory management (Safety Culture, 2022).

Ship management plays a crucial role in the global shipping industry. This pertains to the practice of overseeing and controlling a group of vessels, or alternatively, a solitary vessel. This practice is carried out by firms that utilize vessels owned by other companies or independent owners. The ship management business is responsible for the management of ships on behalf of the owner, and remunerates the owner with an annual sum that is mutually agreed upon between the two parties. In addition, it should be noted that the ship's proprietor enters into a contractual agreement and then grants a lease of the ship to the ship management firm for a specified period of time. In the event of dissatisfaction with a company's performance, the ship owner has the option to either maintain their business relationship with the same company or seek an alternative provider. The proprietor has the option to either lease the vessel or avail themselves of certain services offered by such enterprises. Engaging the services of a ship management business can offer notable benefits to shipowners without prior experience in the industry or those who may face constraints in terms of time and resources to handle such responsibilities. The practice of saving time and resources for the owner while simultaneously generating substantial revenues is advantageous (Marine Insight, 2022).

3.2.Crew Management and Training

Strategic human resource management serves as a means to enhance the performance of a knowledge-based organization by establishing a connection between the human resources function and managerial processes. This connection is achieved via the alignment of human resource policies and practices with the strategic objectives set by management. The process of employee development is an integral aspect of strategic human resource management, commencing with the recruitment phase and extending throughout the interviewing process for prospective cadets and sailors. This practice is deemed essential in identifying and selecting the most suitable individuals to join the maritime organization. A marine enterprise has the capacity to implement certain human resource strategies, including continuous training initiatives and periodic performance evaluations, in order to facilitate optimal performance among seafaring personnel. The augmentation of productivity within a marine organization can be achieved through the implementation of effective human resource planning and the seamless integration of human resource plans with business strategies(Jayaraman, 2023).

The personnel of a marine company plays a crucial role in driving innovation and adaptation, particularly in challenging and dynamic market environments. Undoubtedly, individuals constitute the most invaluable resources within the maritime sector. Consequently, it is imperative for organizations to allocate resources towards addressing the deficiency in skilled personnel (Johns, 1993). Failure to do so may result in a competitive disadvantage, particularly in light of the prevailing scarcity of adequately qualified and experienced seafarers, onshore personnel, and shipyard laborers on a worldwide scale.Organizations have the imperative to identify novel approaches for recruiting and maintaining their important human resources, while also preparing for the changing experiences, expectations, and aspirations of forthcoming generations (Yang et al., 2009). Similar to other industries on a global scale, the marine industry has undergone substantial changes in the human resources (HR) domain throughout recent decades. The traditional "personnel department" has been substituted with Human Resources (HR) departments, facilitating enhanced engagement and communication between employers and employees. In contemporary discourse, employee engagement has expanded its scope to encompass various aspects, including resource management, training opportunities, and continuous career development. These dimensions have gained prominence alongside traditionally considered matters such as payroll

deductions, vacation policies, sick leave entitlements, and retirement plans, which are comparatively of lesser significance(Jayaraman, 2023).

HR is a crucial business lifeline, and progressive organisations fully integrate it throughout the entire organisation. The Human Resources (HR) department, being a vital component of every organization, assumes a significant responsibility in several aspects such as recruitment and termination processes, fostering professional growth and training, conducting performance assessments, implementing workplace wellness programs, and facilitating the establishment and communication of corporate values.The advent of new technologies in the market will lead to a transformation of traditional employment into more knowledge-intensive roles, necessitating employees to possess distinct skill sets compared to their predecessors. There is a growing consensus that with the rising complexity of ships, there is a corresponding demand for seafarers and shipyard staff to possess progressively advanced technical abilities (Yang et al., 2009).The HR department within contemporary maritime organizations must recognize that younger employees perceive digital solutions as the primary means of engaging with training, internal communications, and professional development. The current advancements in digital transformation are already influencing several aspects of HR. However, the formulation of strategies that are resilient to future changes will require a considerable amount of time (Jayaraman, 2023).

The crew, which comprises the workforce of ships, represents a distinct group of employees due to the unique characteristics of their job tasks. The operational setting of a vessel inherently generates circumstances that exhibit notable disparities when compared to the same conditions seen on terrestrial surfaces. Moreover, in contrast to the human resources in office settings, the labor market for crews is not constrained by geographical boundaries. This is due to the fact that the labor market for sailors operates on a worldwide scale (Theotokas, 2009).

The advancements in ship design, construction, and equipment have led to a notable decrease in crew size, while simultaneously intensifying the working conditions experienced by seafarers. Over the past decade, sailors have experienced a significant rise in their workload due to the implementation of a series of laws pertaining to vessel operations. The Danish Maritime Authority (2013) highlights the significant negative impact experienced by seafarers due to the extensive, intricate, and time-consuming bureaucratic responsibilities they are required to handle. The laws aim to prioritize the human element and address issues

related to training and safety. However, due to insufficient consideration of seamen's workload throughout the drafting process, these regulations do not completely achieve their intended objective.Simultaneously, the pursuit of cost-effective seafarers has given rise to the presence of multicultural crews. However, insufficient consideration has been devoted to the process of socializing crew members, thus leading to the emergence of circumstances characterized by feelings of alienation. The implementation of laws such as the International Ship and Port Facility Security Code (ISPS Code), which limits seafarers' access to shore leave at ports, contributes to circumstances that can be likened to a state of "house arrest" on land (Theotokas, 2009).

Numerous organizations endeavor to use the benefits offered by communication technology, both in the efficient administration of the vessel and in fostering contentment and unity among the crew. Given the advancement of time and the development of requisite technological infrastructure, it is anticipated that well-organized shipping companies will increasingly prioritize the provision of unobstructed and continuous communication opportunities for their crew members with the external environment. This is primarily driven by the recognition that facilitating communication between crew members and their families during voyages is a significant factor in attracting and retaining personnel. According to recent research conducted by Papachristou et al. (2015), it is evident that inadequate familial communication is the primary factor contributing to the abandoning of the seafarer's occupation.

The crewing department assumes the responsibility for managing the staff of the vessels. The responsibility of the crewing department is the recruitment and deployment of competent and skilled personnel for ships, their professional development through training programs, strategic career planning, and the settlement of any associated matters (Theotokas, 2009).

The establishment of a distinct crewing department is necessitated by the presence of a crew and the unique attributes associated with the seafaring profession. This requirement remains applicable even in the context of small enterprises, as it demands the presence of office personnel dedicated to the management of labor-related matters pertaining to seafarers. In the premises of a shipping firm, which oversees a fleet of 10 vessels and employs a shore workforce ranging from 25 to 30 individuals, the total number of seafarers can exceed 280. This figure encompasses both the crew members currently on board the ships and those who are on temporary leave on land. The necessity of establishing a distinct department for crew

management is relevant to shipping businesses that do not adopt the practice of outsourcing crew management functions to external partners.The composition of the crewing department's workforce is determined by persons who have prior experience as seafarers. These individuals have firsthand knowledge of working on a ship, enabling them to comprehend the attitudes and behaviors of seafarers and empathize with their requirements (Theotokas, 2009).

Considering the fact that the personnel on board each vessel constitutes a collective unit that operates and resides far away from the central offices of the shipping company, it is imperative to carefully select the crew in a manner that guarantees their unity and effectiveness. This selection process should prioritize their capacity to function optimally and securely, both during routine operations and in critical situations. Ensuring the preservation of this final attribute becomes increasingly challenging when dealing with vessels that employ multinational personnel. Multiple studies examining the management of cultural diversity and safety practices within shipping businesses have highlighted the significance of national culture and other elements that contribute to differentiation among crew members (Progoulaki and Theotokas, 2016).

The global labor market for seafarers consists of multiple individual marketplaces, which allows for the differentiation of sailors into various groups and the provision of varying levels of compensation to them. In order for shipping businesses to effectively use these variations, it is imperative that they possess the ability to not only discern distinct markets, but also to allure and include skilled seafarers from various areas. According to Theotokas (2018), when decision-makers lack the requisite knowledge and information to make a choice, and the cost of acquiring such knowledge exceeds the potential benefits, outsourcing the relevant activity to enterprises with the necessary expertise becomes an appealing strategic alternative (Theotokas, 2009).

Based on the aforementioned, the administration of crews can be conducted by either a dedicated department within the organization, a specialized subsidiary, or entirely outsourced to other entities such as ship management or crew agents. The selection is influenced, among other factors, by the methodology employed in the cultivation of the workforce inside the organization's fleet (Theotokas, 2009).

3.4.Safety Management& Maritime Security in Dry Shipping

According to Cahill (1990), ship owners have historically placed a relatively low emphasis on safety as a priority. The primary focus of their endeavors has consistently been and may continue to be the pursuit of financial gain through profit generation. The current framework for guaranteeing maritime safety has been established relatively recently, however certain components of these regulations may be traced back to earlier periods. The first attempts are those that were developed by the Lloyd's Register of British and Foreign Shipping, an organization founded in 1834, thereby formalizing the notion of safety and risk analysis (Bahr, 1997). According to Cahill (1990), the restrictions implemented by insurance organizations were intended to guarantee the suitability of ships for their intended purposes. However, it is argued that these requirements frequently incentivized ship owners to neglect operational safety factors. The prevailing attitude appeared to be one of laissez faire, with the individuals being confident in the knowledge that they were protected by their insurance providers(Amanyire, 2007).

A significant turning point occurred with the sinking of the renowned Titanic in 1912. The aforementioned vessel embarked on its journey with the prevailing belief among its passengers that it was impervious to sinking. However, contrary to these expectations, the ship ultimately met its demise. As a result, inquiries arose regarding the ship's design and safety measures, namely pertaining to the life-saving equipment present on board. In response, the global community at that particular juncture convened a meeting and reached a consensus on an International Convention aimed at establishing standardized regulations pertaining to the Safety of Life at Sea (SOLAS). The Convention in question encompassed various domains, including navigation safety, construction standards, radiotelegraphy, life-saving equipment, and fire prevention. Its central focus was around ensuring the safety and well-being of individuals at sea. The aforementioned approach introduced the well recognized reactive and prescriptive methodology for implementing maritime safety rules, which remains in effect and serves as the foundation for contemporary shipping safety practices. The aforementioned methodology has led to the establishment of numerous regulatory measures, resulting in the International Maritime Organization (IMO) currently serving as the repository for over 50 conventions that govern international shipping(Amanyire, 2007).

The International Maritime Organization (IMO) is an enduring global institution with the authority and expertise to enact regulations pertaining to all aspects of maritime safety.

Nevertheless, the member nations bear the duty for executing and upholding the conventions. The subsequent enumeration comprises the Conventions that pertain to the domain of maritime safety:

«• International Convention on Load Lines (LL) 1966

• International Convention on the Safety of Life at Sea (SOLAS) 1974

• Convention on the International Regulations for Preventing Collisions at Sea (COLREGS), 1972

• International Convention for Safe Containers (CSC), 1972

• International Convention on Standards of Training , Certification & Watchkeeping for Seafarers (STCW), 1978

• Special Trade Passenger Ships Agreement (STP), 1971

• The Torremolinos International Convention for the Safety of Fishing Vessels (SFV), 1977

• Protocol on Space Requirements for Special Trading Passenger Ships, 1973

• Convention on the International Maritime Satellite Organisation (INMARSAT), 1976

• International Convention on Standards of Training, Certification and Watchkeeping for Fishing Vessel Personnel (STCW – F) 1995; and

• International Convention on Maritime Search and Rescue (SAR), 1979.»

(Amanyire, 2007)

While other conventions pertaining to maritime safety are considered to be complementary to SOLAS, which is widely acknowledged as the foremost regulation for ensuring safety at sea (IMO, 1998), another convention known as the International Convention on the Prevention of Marine Pollution from Ships 1973/78 as amended (MARPOL) is specifically focused on addressing marine pollution. However, MARPOL does include provisions that establish design standards for specific categories of ships, such as tankers, with the aim of enhancing the safety of these particular vessel types. It is important to acknowledge that in instances where a ship experiences failure due to safety dangers encountered at sea, resulting in sinking or breach of its hull, it has the potential to pose a threat to the marine ecosystem by leaking pollutants into the surrounding waters. The interconnection between maritime safety and marine environmental protection has been emphasized by Gold (2006), who argues that these

two aspects are inseparable. Similarly, Franson (2005) suggests that the cultivation of a culture focused on marine environmental preservation should be integrated into the broader culture of maritime safety. The regulations mentioned above share a common underlying concept, which is to provide ship owners with guidelines on how to attain the necessary or minimal standards of safety. The International Convention for the Safety of Life at Sea (SOLAS) and the International Convention on Load Lines (LL) are both concerned with the ship's design aspects. For several decades, they have played a major role in the implementation of safety management within the shipping industry (Amanyire, 2007).

However, it should be noted that this strategy is a result of legislation implemented by classification organizations and particular governments, rather than being driven by ship owners or ship management. The objective of the standards is to enhance the safety of ships by incorporating safety measures within their design. It is commonly acknowledged that throughout history, significant accidents have often prompted the establishment of new regulations and procedures. Notable examples include the Titanic disaster, which led to the development of the International Convention for the Safety of Life at Sea (SOLAS); the Exxon Valdez oil spill, which resulted in the enactment of the Oil Pollution Act; and the Amoco Cadiz incident, which prompted the implementation of the International Convention for the Prevention of Pollution from Ships (MARPOL) and the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW). Typically, these newly implemented regulations and criteria have elements aimed at enhancing ship design standards with greater stringency. The current situation demonstrates that numerous legislation aimed at preventing maritime accidents have been implemented and approved without undergoing a comprehensive risk assessment, which is often expected for proactive safety measures (Amanyire, 2007).

The SOLAS International Convention governs the regulations pertaining to occupational health and safety. The pact was initially ratified in 1974; however, further revisions and supplements have been made, consistently augmenting the prescribed security thresholds. Modifications and additions are outcomes derived from the assessment and subsequent conclusions drawn from the review of various accidents or occurrences within the maritime sector. Currently, the International Convention for the Safety of Life at Sea (SOLAS) is adhered to by a total of 162 nations and has a global reach that encompasses 99% of the entirety of commerce shipping(Saligkara, 2021). The treaty has numerous articles that establish the lowest acceptable thresholds of safety in relation to the building, equipment, and

operation of a ship. In general, the content encompasses the subsequent components: ship construction, construction components and stability, as well as electromechanical equipment, ship fire protection, detection, and firefighting, lifeboats of the vessel, radio communications, navigation and safety, freight and security, the transportation of hazardous materials and its associated safety measures, nuclear-powered watercraft, management of ensuring the safe navigation of a ship, safety measures implemented on speedboats, special measures aimed at enhancing shipping safety(Saligkara, 2021). In order to enhance the safety of dry cargo ships, it is imperative to implement supplementary precautions. The adherence of the shipping firm to anticipated protection and safety protocols is contingent upon the inspections conducted on the vessel by both the classification society and the occasional port controls, known as Port State Control. Port State Control refers to the examination conducted by designated inspectors from Port Authorities on foreign-flagged vessels, with the objective of assessing the ship's adherence to the regulations outlined in international treaties such as SOLAS and MARPOL. The non-compliance of the ship with international conventions may result in financial repercussions for the corporation, since the ship is prohibited from embarking until the identified issues are rectified (Berg, 2013).

Businesses engage in strategic planning to determine their future course of action within the context of their operations. The duration of this plan varies based on the time frame in which it is executed, encompassing long-term, medium-term, and short-term periods. During the design phase, specific assumptions or conditions are considered, which serve as the basis for determining the company's ability to achieve its goals within the designated time frame. The objectives and parameters are established based on the historical performance of the organization. The figures are derived on historical data from past years, during which the company operated under standard conditions. According to Kaplan and Garrick (1981), during the execution of a company's strategies, unforeseen alterations in both the internal and external environment may arise, primarily resulting from imbalanced forces that are frequently outside the control of the organization itself. The differentiation in question poses a potential risk to the attainment of the stated aims and anticipated outcomes. The occurrence of the aforementioned event presents a risk to the planning and execution of the company's commercial activities, necessitating proactive measures to mitigate and manage it. The base and source of all uncertain facts, referred to as risks, inside a company's pursuit of desired outcomes, is derived from the dynamic nature of its surroundings(Saligkara, 2021).

The determination of risk involves the assessment of both the likelihood of an unknown event occurring and the magnitude of its impact. When determining this probability, historical data from prior years of the organization is utilized. The utilization of previous data is employed for the computation of anticipated outcomes, such as the Expected Return for financial results. This calculation simply involves the determination of a weighted average based on prior data. Statistics is employed to compute several metrics, including variance, standard deviation, and variance at risk (VaR), which provide insights into the likelihood of attaining the anticipated outcome. According to Adler and Dumas (1984), based on statistical analysis, there exists a positive correlation between the probability of attaining the anticipated outcome and the level of risk involved. Nevertheless, there exists a direct relationship between the anticipated outcome, also known as the Expected Return, and the level of risk involved. In other words, as the level of risk increases, so does the potential for a larger expected return. Companies do not undertake significant risks unless they are well compensated. In the context of project selection, companies typically exhibit a preference for initiatives with lower risk when faced with a choice between two projects that offer the same anticipated outcome in terms of expected return (Saligkara, 2021).

3.5.Environmental Safety Management& Health Management

Establishing a connection between safety and environmental protection within the maritime sector is a relatively straightforward endeavor. The occurrence of disasters such as the Exxon Valdez, the Erika, and the Prestige has demonstrated the close association between the two entities. The safety of a ship that is well-designed and constructed is primarily contingent upon the actions and responsibilities of the seafarer. Assuming that seafarers possess appropriate training and certification in accordance with the STCW Convention, their subsequent actions are significantly affected by the employing organization.

According to Cox (2007), the individual engaged in the task must possess sound mental and physical well-being, as any compromise in these aspects may render them vulnerable to making mistakes, whether in terms of decision-making or elsewhere. As previously emphasized, the occupation of seafaring possesses distinct characteristics that differentiate it from other professions. The impact of psychosocial strain and working conditions on individuals' health has been found to have a significant influence on their performance. This is particularly relevant in the context of maritime occupations, where the safety aspect is of utmost importance across various job roles (Carter, 2005). Therefore, it is imperative to prioritize the mental and physical well-being of seafarers as the primary focus of error

management. This should be done not solely for the purpose of certification in line with the STCW, but also during their operational activities and tours of duty. From this standpoint, it may be argued that a seafarer who maintains good health is less prone to making mistakes, thereby resulting in a decrease in accidents that occur on board. Furthermore, effective management of other organizational concerns, like as weariness, can also contribute to a reduction in errors during navigation. This statement serves as the foundational basis for the International Safety Management (ISM) Code in its entirety (Amanyire, 2007).

The International Safety Management Code (ISM Code) refers to the internationally recognized code that governs the safe operation of ships and the prevention of pollution. It was officially adopted by the International Maritime Organization (IMO) assembly. Adopted in November 1993, the ISM Code came into force in July 1998. The inclusion of this provision may be found within the SOLAS Chapter IX, which pertains to the management practices implemented to ensure the safe operation of ships(Edu Maritimes, 2023). It is recommended that companies adopt a comprehensive strategy for safety and environmental protection. This policy should outline the strategies and measures necessary to attain the objectives and effectively execute the International Safety Management (ISM) Code. It is imperative for such a strategy to prioritize the company's dedication to attaining the utmost safety management standards across all levels of the business, while concurrently safeguarding the environment within the scope of its operations.Shipping companies should define and document the responsibility and authority and provides adequate resources to the personnel such as Designated Person. In addition, the organization is required to consistently enhance the quality and safety of its services, while ensuring compliance with both national and international rules, as well as pertinent standards and guidelines (Edu Maritimes, 2023).

In pursuit of decarbonization within the industry, a mandatory requirement was implemented in January 2023, necessitating all ships to compute their Energy Efficiency Existing Ship Index (EEXI). This index serves as a metric for assessing the energy efficiency of ships and facilitates the collection of data for reporting their annual operational carbon intensity indicator (CII) and CII rating. For further information, please refer to the following source.The implementation of more stringent laws pertaining to carbon emissions has led to a rising level of industry engagement in exploring various strategies to attain the objective of zero emission vessels. The underestimated influence of biofouling on emissions is substantial. Based on a report released by Glofouling in October 2022, it has been suggested that the use of measures to safeguard ships against biofouling might potentially result in a

reduction in carbon dioxide (CO_2) emissions by up to 19% within the industry. Numerous stakeholders within the industry have also acknowledged the significance of advanced hull performance solutions in reducing emissions and have begun to prioritize the importance of biofouling management as a means of enhancing environmental efficiency. The International Maritime Organization (IMO) has published a study indicating that biofouling is an indirect contributor to an estimated annual emission of around 79 million tons of carbon dioxide (CO_2). The cleanliness of a vessel's hull significantly contributes to the reduction of emissions (JOTUN, 2023).

The International Safety Management (ISM)Code mandates that a shipping business must implement measures to mitigate any recognized risks. Shipping businesses utilize various ways to risk assessment in the absence of specific standards pertaining to the methodology employed. Certain organizations delegate the responsibility of conducting risk assessments and creating a comprehensive risk assessment document to their internal managers, while others opt to engage external contractors for this purpose. This approach allows those on board to have access to a reference document including the risk assessment findings, without necessarily seeking input or feedback from relevant stakeholders (Anderson, 2003).

The management of shore side top ship operations should effectively communicate to the sea-going employees their unwavering dedication to the Safety Management System (SMS). Consequently, prioritizing safety over expediency on demanding sailing schedules should be emphasized. The workers' (seafarers') sense of management commitment plays a crucial role in ensuring that, when faced with time constraints to achieve deadlines, they refrain from resorting to expedient measures. In order to assess the extent to which managers effectively communicate their commitment to safety, it is necessary to employ safety climate surveys to gauge the perceptions of the workforce regarding managers' attitudes and behaviors. Additionally, to evaluate the direct impact of managers on safety, an upward appraisal survey can be utilized. The aforementioned obstacles can be overcome by a shipping company that demonstrates prudence and prioritizes the safety of its employees, property, and the marine environment. There exist numerous techniques to risk management, one of which is the formal safety assessment system proposed by the International Maritime Organization (IMO). The absence of a specific method specified in the Code allows organizations to select the strategy that aligns most effectively with their needs. While it is possible for a shipping company to initially develop a culture of compliance during the installation phase, it is reasonable to anticipate that the company will transition beyond this stage once the

advantages of the system have become evident. It is imperative to establish verifiable methods for demonstrating management commitment. For instance, in the context of safety training coordination, it is advisable for senior management to prioritize their participation in the training program. This proactive measure serves to demonstrate their unwavering dedication to safety to all employees within the organization. The present state of advancement in information technology offers a promising means to effectively mitigate the burdensome administrative task of managing and processing large volumes of paperwork(Amanyire, 2007).

3.6.TMSA

The Tanker Management & Self-Assessment (TMSA) program, initiated by the OCIMF in 2004, serves as a mechanism for corporations to effectively review, appraise, and enhance their safety management systems (Giannelou, 2019). The TMSA program underwent a revision on 1 July 2008, resulting in the development of TMSA2. This revision aimed to update the program's material and integrate any legislative changes that had occurred since its inception. Additionally, TMSA2 sought to include new best practices relevant to the industry. The transition from TMSA2 to TMSA3 occurred in April 2017, illustrating the program's commitment to the principle of continuous improvement. This shift signifies that the program not only expects participating managing businesses to strive for continuous improvement but also embodies this principle within its own operations. The TMSA programme operates in conjunction with preexisting norms and regulations, with its primary aim being the promotion of "self-regulation" and the ongoing enhancement of operational and managerial practices inside managing businesses (Βαζιντάρη, 2017).

Although SOLAS (Safety of Life at Sea) and the ISM Code (International Safety Management Code) were established to enhance maritime safety and mitigate marine pollution, the ultimate responsibility for their implementation rests with the managing companies and their adherence to existing and future legislation via their safety management systems. The TMSA programme aims to assist companies in enhancing their safe management systems by facilitating a self-assessment process (Karti, 2017). This involves evaluating their systems against established Key Performance Indicators and providing guidance on best practices. The programme supports managing companies in attaining optimal levels of safety and standards of excellence. Within the context of evaluation and comparison utilizing Key Performance Indicators and best practices, management companies are encouraged to utilize their findings to develop an enhancement strategy with the objective

of attaining superior levels of safety. Consequently, the primary goal is not solely to achieve the highest level of compliance with the TMSA program recommendations, but rather to consistently identify novel approaches for enhancing the current safe management system. This includes incorporating various elements provided by the environment to mitigate the risk of accidents or environmental catastrophes, such as insights from OCIMF, classification societies, flags, as well as internal failures that serve as valuable lessons. The process of evaluating one's own performance, benchmarking against industry standards, and formulating a strategy for enhancing operations is documented in the form of a report within the TMSA database. This database is accessible exclusively to members of the OCIMF, who are the prospective charterers of the vessels.

Since its inception in 2004, the TMSA program has garnered significant acceptance, as evidenced by the participation of over 90% of tanker operating businesses. The benefits of using the Tanker Management and Self-Assessment (TMSA) program in ship management are evident (Βαζιντάρη, 2017):

- The implementation of effective safe management systems contributes to a reduction in accidents.

- The adoption of continuous improvement practices in management is encouraged and reinforced.

- The incorporation of a preventive maintenance approach aids in minimizing unexpected ship stoppages and delays associated with necessary repairs.

- The implementation of preventive maintenance measures results in a decrease in the likelihood of accidents, delays, and breakdowns. This, in turn, leads to enhanced safety and environmental performance over time.

These improvements indirectly contribute to the enhancement of the company's reputation and financial standing. As a result, the company experiences improved charter prospects for its ships and higher freight rates. Companies that integrate the TMSA (Karti, 2017) programme guidelines and regulations into their safety management system are regarded as possessing and implementing a proactive evaluation procedure, regardless of whether their vessels have undergone inspection through the SIRE network. The gradual decrease in the occurrence of accidents over a period of time leads to a decrease in expenses for ship insurance and an increase in profits for the managing business. The TMSA programme

primarily functions as an internal mechanism within the controlling business. The collaborative efforts of corporate executives are directed at identifying any shortcomings or deviations in the safe management system, as well as determining the most widely recognized best practices. Subsequently, they engage in a collective endeavor to identify viable and enduring strategies for rectifying any identified deviations and failures (Βαζιντάρη, 2017).

3.8.Dry BMS

The initial release of the Dry Bulk Management Standard (DryBMS) occurred on April 2, 2020, with the publication of the first draft version titled DBMS. This version was made accessible to the public through the official website of the Standard, which can be found at https://drybms.org. Subsequently, RightShip has undertaken the task of gathering feedback from the industry and periodically releasing updated sections of the first proposed Standard in response to the collected comments.A joint press release by RightShip and INTERCARGO announced the publication and endorsement of the final draft version of DryBMS.The anticipated release date for the final iteration of DryBMSoccured by the end of 2021 (Bicen & Celik, 2023). This version will be overseen by a newly constituted non-governmental organization (NGO) specifically created to fulfill this objective. While the implementation of DryBMS in companies that oversee Bulk Carrier vessels is said to be optional, insights from the Tanker Industry and TMSA suggest that DryBMS will introduce a novel era in the Dry Bulk Sector. Consequently, the sector will need to adjust its operations to meet the forthcoming unparalleled requirements(Alpha Marine, 2021).

As stated on the official website, DryBMS is a comprehensive collection of tools and materials designed to enable ship management to conduct self-assessments and enhance or sustain their operational effectiveness. The notion of self-assessment is not a novel concept within the maritime industry. The Tanker Management Self-Assessment (TMSA) developed by the OCIMF was introduced in 2004 specifically for implementation in the Wet Sector(Βαζιντάρη, 2017). Similar to the Tanker Management and Self-Assessment (TMSA) framework, the managers of Bulk Carriers are required to evaluate the efficacy of their Safety Management Systems (SMS) in accordance with the prescribed benchmarks, utilizing the Dry Bulk Management System (DryBMS). This method will enable ship managers to evaluate their performance in relation to industry standards, identify areas of deficiency, establish improvement targets, and implement strategies to accomplish their objectives(Alpha Marine, 2021).

The Dry Bulk Management System (DryBMS) comprises a comprehensive self-assessment questionnaire that encompasses 30 distinct subject areas organized into four overarching categories: performance, people, plant, process. The DryBMS program incorporates four levels of compliance across each subject area, namely Basic, Intermediate, Advanced, and Excellence. Justification of compliance with the requirements of each level is performed gradually on the basis of a system of percentages per level (0% – 25% – 50% – 75% – 100%).

Unless the score for the basic level attains 100%, the scores for the intermediate, advanced, and excellence levels will be evaluated at 5% of the self-assessed score.In the absence of perfect results at both the basic and intermediate levels, the advanced and excellent levels will be evaluated based on 5% of the self-assessed score.The implementation of DryBMS addresses a discernible requirement for the establishment of a universally applicable Standard that fosters a culture of ongoing enhancement and reinforces the safety culture inside shipping companies.The adherence to the heightened criteria established by DryBMS poses a significant and important obstacle that Bulk Carrier management companies must confront. Therefore, the successful adjustment to this novel situation necessitates the collective endeavors of all those involved and impacted. Amidst the ongoing Covid-19 pandemic and its impact on the Maritime Industry, it is crucial to capitalize on the introduction of DryBMS and establish a strategic plan to enhance operational efficiency and achieve excellence in Health, Safety, Quality, and Environmental (HSQE) practices (Alpha Marine, 2021).

The Dry Bulk Management Standard (DryBMS) is designed to assess the quality of a company's Safety Management System (SMS) based on quantifiable benchmarks and objectives, hence eliminating the need for extensive inspections. Companies can enhance their safety performance, as well as the overall performance of the industry, by evaluating their management systems against voluntary standards and implementing ongoing improvements to reach higher levels. The standard delineates 17 priority subject areas that are deemed to exert the most significant influence on safety, environmental concerns, and operational efficacy. In the event that firms possess ample resources, it is advisable for them to conduct a comprehensive self-assessment across all 30 topic areas. However, it is acknowledged that certain smaller companies may encounter challenges in addressing all areas simultaneously. Consequently, it is recommended that these companies initially concentrate their efforts on the key areas before gradually expanding their scope to encompass the remaining subject areas (SQE, 2021).

Chapter 4: Methodology

4.1.Aims of the research

The present research aims to investigate the shipping employees' opinions about the DryBMS and the challenges of its implementation, but also the benefits it provides. Additionally, it is investigated whether their current role in the dry shipping industry affects their opinion about the role of DryBMS in the future. Lastly, the research focuses on the effect that the training in DryBMS offered by the companies, affect the employees' opinions as of the most important benefit and challenge of the implementation of DryBMS. According to the above, the research questions that are investigated are the following ones:

- The employees' role in dry shipping industry affects their opinions about the future of DryBMS?
- The company's choice to offer training to the employees about DryBMS affects their opinion about the challenges and benefits DryBMS offers?

4.2.Sample

The sample of the present research is consisted of 120 participants, who work in dry shipping industry. More specifically, the majority of the participants are ship managers and have an experience in the dry shipping industry from 6 to 10 years. Additionally, most of the employees mention that the geographic region that best describes their work location is Europe. Lastly, it should be mentioned that all the participants are aware of DryBMS.

4.3.Research tool

The research tool that was used to investigate the aims of the research and answer to the research questions that were mentioned above, is a questionnaire. The tool is consisted of a total of 15 close-ended questions. The first 3 questions, focus on the participants' working characteristics and more specifically in their role in the dry shipping industry, the years of experience in the mentioned industry and the geographic region in which they work. The following 3 questions analyze the participant' awareness and implementation of DryBMS, while 3 more question focus on the human element in dry shipping. As for the participants' opinions about challenged and benefits are analyzed through 2 close-ended questions and 2 more focus on the training that the participants received from their company about DryBMS.

The 2 last close-ended questions analyze the participants' opinions about the future of DryBMS.

4.4.Data collection

The data collection was achieved with the use of a proper Google form. The file contains all the variables of the research tool, while it is accompanied by an introduction note, which informs the participants about the aims and goals of the research. It also makes clear that the participation is anonymous and voluntary and that the needed time to complete the questionnaire is 5 to 7 minutes. Additionally, it offers the researcher's electronical contact information, in case the participants have a problem during the research or have questions. Lastly, it encourages the participants to reply truthfully to all the questions and reminds them that their participation would not affect in any way their work and their relationships with their supervisors.

4.5.Data analysis

The data was analyzed through the SPSS v25 program, while the Microsoft Excel program was also used. The collected data was coded and then frequencies and percentages were calculated to present all the findings. Additionally, the Chi-Square test and the Crosstabulation Analysis were used, ini order to reply to the research questions. The above are presented in tables and graphs that were created by the researcher in the mentioned programs.

Chapter 5: Results

In the following chapter, the results of the questionnaire are presented, while the research questions are also replied.

Table 1 presents the distribution of current roles within the dry shipping industry. The largest group comprises Ship Managers, constituting 25.0% of the respondents. Following closely are Crew Members at 21.7%. Maritime Regulators make up 17.5% of the respondents, while Shipowners/Operators represent 16.7%. Port Authorities account for 12.5% of the roles, and there is a smaller category labeled as "Other" at 6.7%. This distribution is graphically depicted in Graph 1.

Table 1. What is your current role in the dry shipping industry

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Shipowner/Operator	20	16,7	16,7	16,7
	ShipManager	30	25,0	25,0	41,7
	CrewMember	26	21,7	21,7	63,3
	Port Authority	15	12,5	12,5	75,8
	Maritime Regulator	21	17,5	17,5	93,3
	Other	8	6,7	6,7	100,0
	Total	120	100,0	100,0	

Graph 1. What is your current role in the dry shipping industry

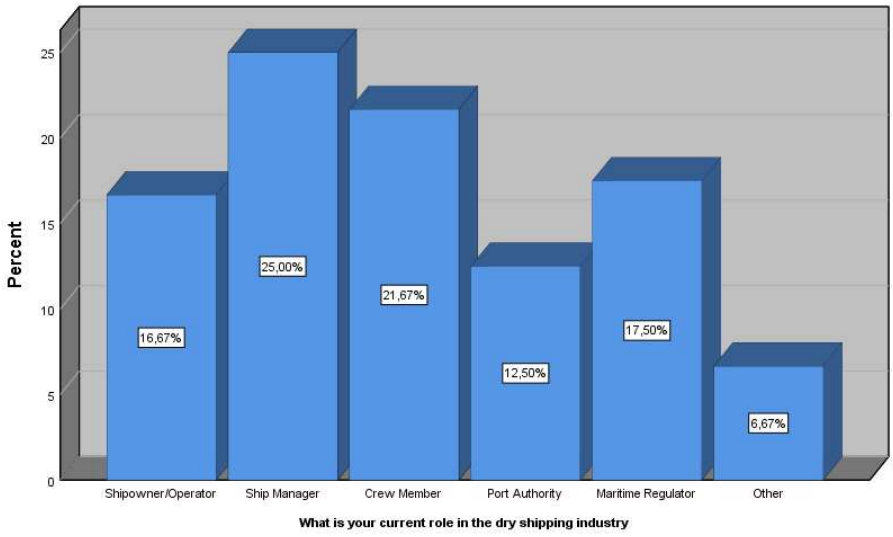


Table 2 and Graph provide insights into the years of experience of individuals in the dry shipping industry. The majority of respondents, 42.5%, have more than 10 years of experience, making them the most experienced group. The next largest group, constituting 35.0% of respondents, has 6-10 years of experience. Those with 1-5 years of experience make up 17.5% of the sample, and a smaller portion, 5.0%, have less than 1 year of experience.

Table 2. How many years of experience do you have in the dry shipping industry

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 1 year	6	5,0	5,0	5,0
	1-5 years	21	17,5	17,5	22,5
	6-10 years	42	35,0	35,0	57,5
	More than 10 years	51	42,5	42,5	100,0
	Total	120	100,0	100,0	

Graph 2. How many years of experience do you have in the dry shipping industry

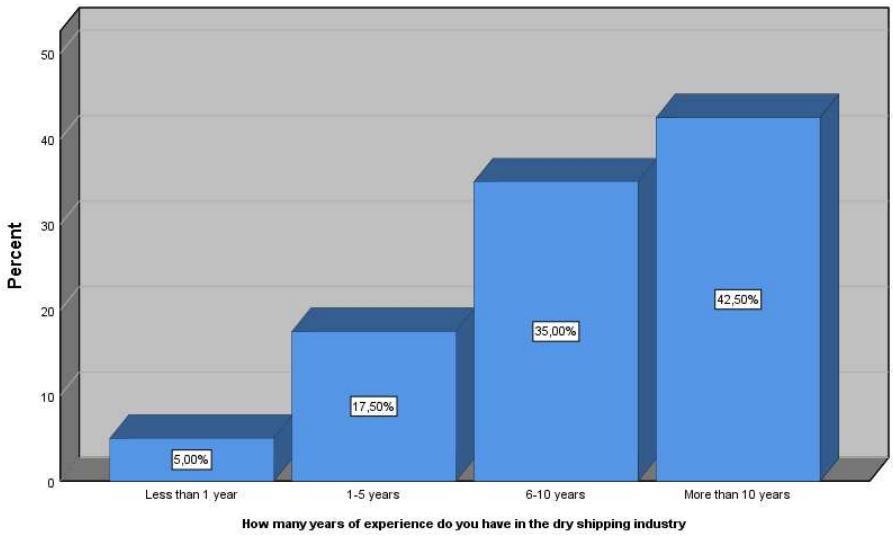
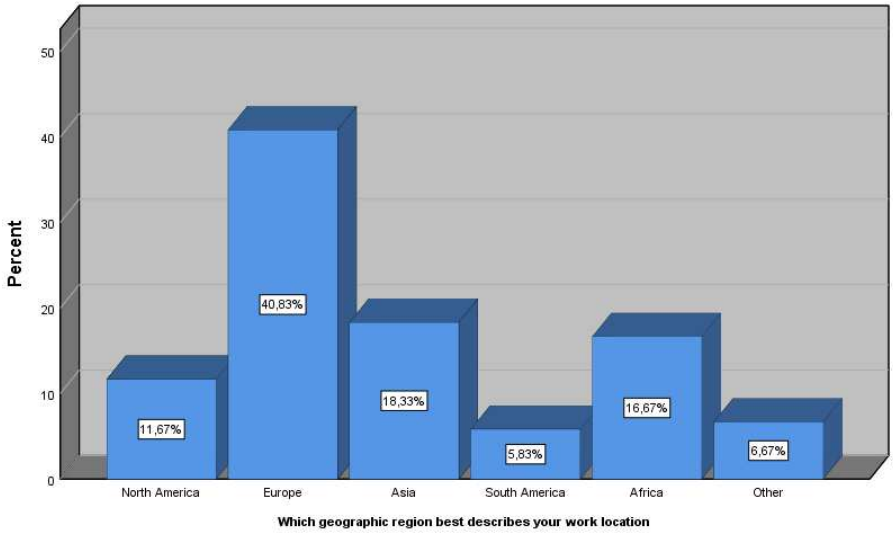


Table 3 and Graph 3 illustrate the distribution of work locations within the dry shipping industry. The largest group, at 40.8%, is situated in Europe, followed by Asia with 18.3%. North America represents 11.7% of respondents' work locations, while Africa accounts for 16.7%. South America is the work location for 5.8% of individuals, and a smaller category, labeled as "Other," makes up 6.7%.

Table 3. Which geographic region best describes your work location

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	North America	14	11,7	11,7	11,7
	Europe	49	40,8	40,8	52,5
	Asia	22	18,3	18,3	70,8
	South America	7	5,8	5,8	76,7
	Africa	20	16,7	16,7	93,3
	Other	8	6,7	6,7	100,0
	Total	120	100,0	100,0	

Graph 3. Which geographic region best describes your work location



Furthermore, it should be mentioned that all respondents, 100% of them, are aware of DryBMS. This means that the entire sample is familiar with DryBMS.

Table 4 reveals that among those who are aware of DryBMS, 65.0% have implemented it within their organizations, while 35.0% have not. This information is visualized in Graph 4.

Table 4. If yes, has your organization implemented DryBMS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	78	65,0	65,0	65,0
	No	42	35,0	35,0	100,0
	Total	120	100,0	100,0	

Graph 4. If yes, has your organization implemented DryBMS

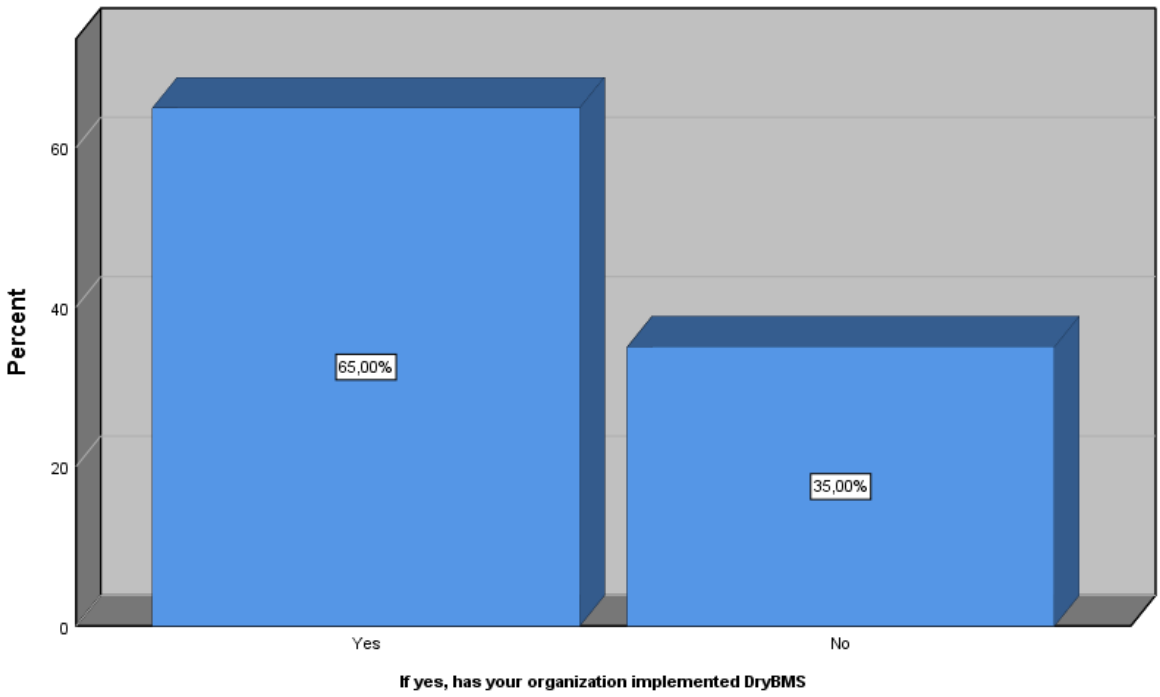


Table 5 and Graph 5 outline the impact of DryBMS on daily operations and decision-making processes for those who have implemented it. The largest portion, 34.2%, mentions that DryBMS has "slightly improved" their operations. Following this, 15.8% report that it has "significantly improved" their processes. However, 15.0% have found that DryBMS "created challenges," and 35.0% experienced "no significant change."

Table 5. If implemented, how has DryBMS affected your daily operations and decision-making processes

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Significantly improved	19	15,8	15,8	15,8
	Slightly improved	41	34,2	34,2	50,0
	No significant change	42	35,0	35,0	85,0
	Created challenges	18	15,0	15,0	100,0
	Total	120	100,0	100,0	

Graph 5. If implemented, how has DryBMS affected your daily operations and decision-making processes

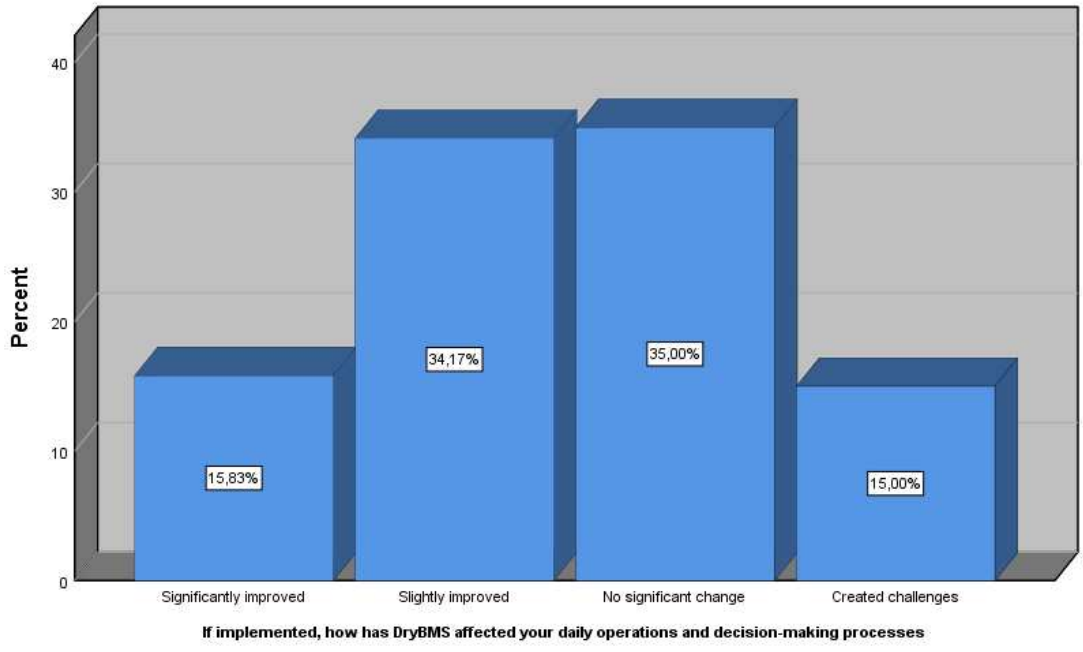


Table 6 and Graph 6 showcase the perceived importance of the "human element" in the dry shipping industry. A significant portion, 34.2%, believes it to be "very important," followed closely by 27.5% who consider it "extremely important." Additionally, 26.7% of respondents find it "moderately important," and 11.7% deem it "slightly important."

Table 6. How important do you believe the "human element" is in the dry shipping industry

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Slightly important	14	11,7	11,7	11,7
	Moderately important	32	26,7	26,7	38,3
	Very important	41	34,2	34,2	72,5
	Extremely important	33	27,5	27,5	100,0
	Total	120	100,0	100,0	

Graph 6. How important do you believe the "human element" is in the dry shipping industry

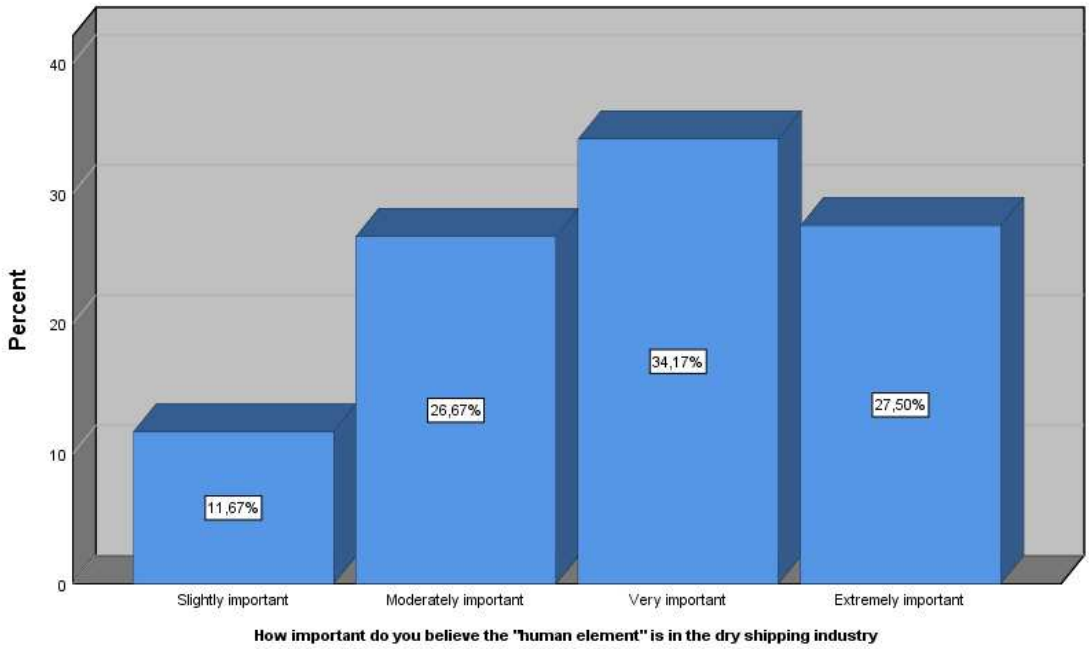


Table 7 gauges the perceived impact of DryBMS on the human element within the dry shipping industry. The majority, at 42.5%, believes that DryBMS has "minimized human errors." Additionally, 26.7% mention that it has "enhanced crew training and education," while 15.0% report that it has "improved safety and well-being." A smaller group, 15.8%, notes that there is "no noticeable impact." These opinions are visually summarized in Graph 7.

Table 7. In your opinion, how has DryBMS impacted the human element in dry shipping

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No noticeable impact	19	15,8	15,8	15,8
	Minimized human errors	51	42,5	42,5	58,3
	Enhanced crew training and education	32	26,7	26,7	85,0
	Improved safety and well-being	18	15,0	15,0	100,0
	Total	120	100,0	100,0	

Graph 7. In your opinion, how has DryBMS impacted the human element in dry shipping

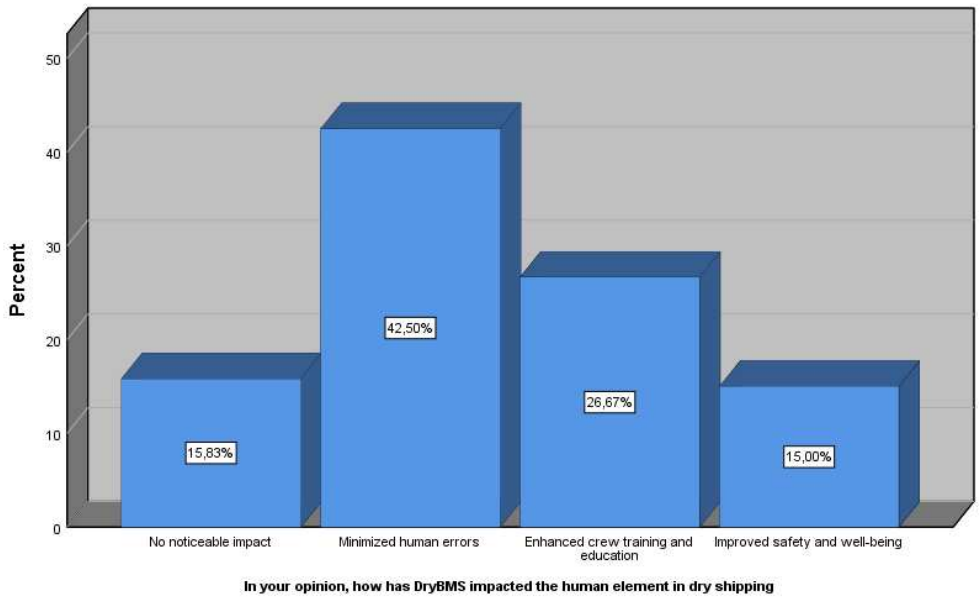


Table 8 highlights the most important changes in safety, efficiency, or crew well-being observed since the implementation of DryBMS in respondents' organizations. For 25.8% of them, the primary outcome has been an "enhanced crew well-being." In addition, 24.2% have experienced a "deterioration in safety," and 22.5% have seen an "improved efficiency." There is also a group of 11.7% who reported "improved safety," while 10.0% mentioned a "deterioration in efficiency." Lastly, 5.8% noted an "adverse impact on crew well-being." These findings are visually summarized in Graph 8.

Table 8. Which is the most important change in safety, efficiency, or crew well-being since the implementation of DryBMS in your organization

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Improved safety	14	11,7	11,7	11,7
	Improvede fficiency	27	22,5	22,5	34,2
	Enhanced crew well-being	31	25,8	25,8	60,0
	Deterioration in safety	29	24,2	24,2	84,2
	Deterioration in efficiency	12	10,0	10,0	94,2
	Adverse impact on crew well-being	7	5,8	5,8	100,0
	Total	120	100,0	100,0	

Graph 8. Which is the most important change in safety, efficiency, or crew well-being since the implementation of DryBMS in your organization

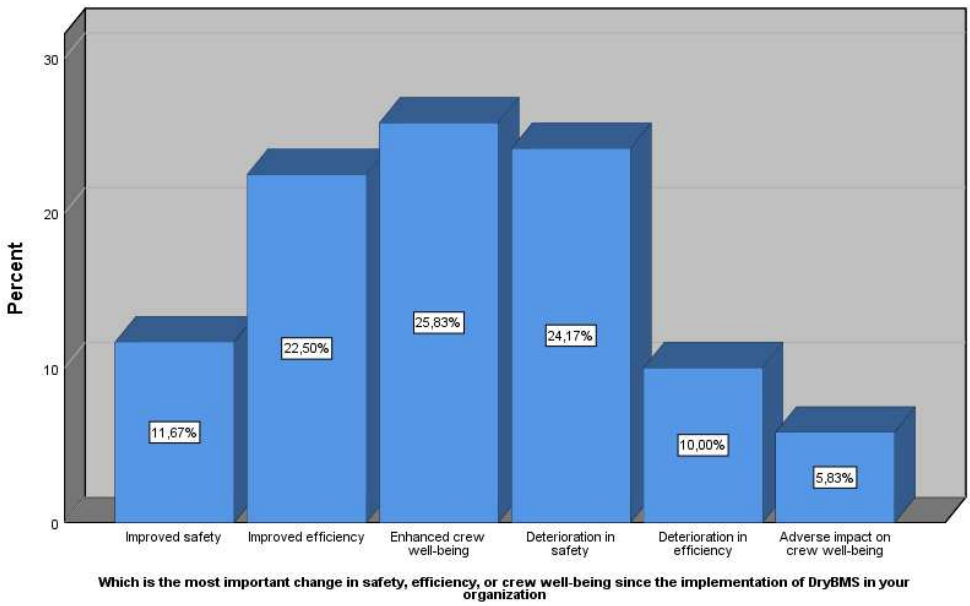


Table 9 outlines the most significant challenges encountered during the implementation of DryBMS. A noteworthy portion, 22.5%, identified a "lack of resources" as the primary challenge, while 20.0% mentioned "resistance to change." Additionally, 16.7% reported a "lack of understanding," and 15.8% faced "regulatory hurdles." A diverse range of challenges, labeled as "Other," was mentioned by 20.8% of respondents. Interestingly, a small group, 4.2%, stated that they encountered "no challenges." These challenges are summarized in Graph 9.

Table 9. Which challenge that you have encountered in implementing DRYBMS is the most important one

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Resistance to change	24	20,0	20,0	20,0
	Lack of resources	27	22,5	22,5	42,5
	Lack of understanding	20	16,7	16,7	59,2
	Regulatory hurdles	19	15,8	15,8	75,0
	Other	25	20,8	20,8	95,8
	No challenges encountered	5	4,2	4,2	100,0
	Total	120	100,0	100,0	

Graph 9. Which challenge that you have encountered in implementing DRYBMS is the most important one

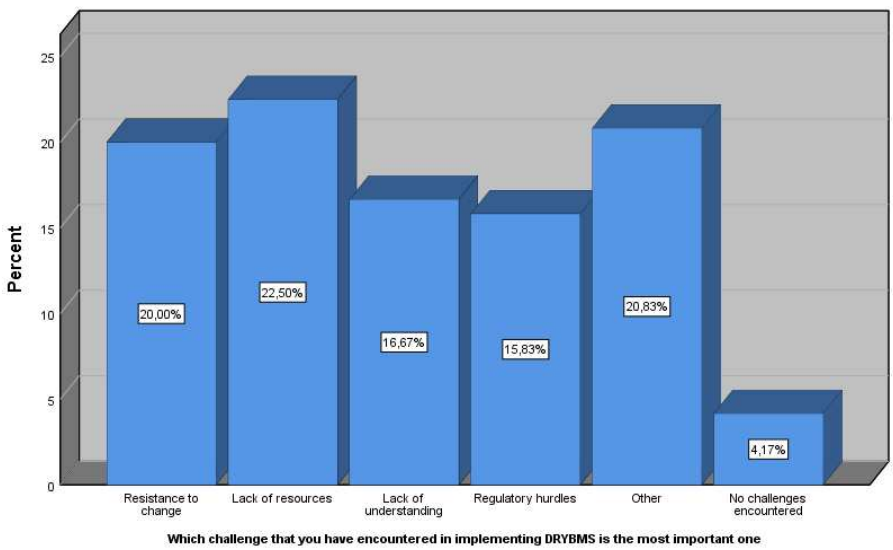


Table 10 and Graph 10, report the perceived tangible benefits resulting from the implementation of DryBMS. A majority, 57.5%, responded affirmatively, indicating that they have seen tangible benefits. In contrast, 21.7% answered "No," while 20.8% were "Not sure."

Table 10. Have you seen any tangible benefits as a result ofDryBMS implementation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	69	57,5	57,5	57,5
	Not sure	25	20,8	20,8	78,3
	No	26	21,7	21,7	100,0
	Total	120	100,0	100,0	

Graph 10. Have you seen any tangible benefits as a result of DryBMS implementation

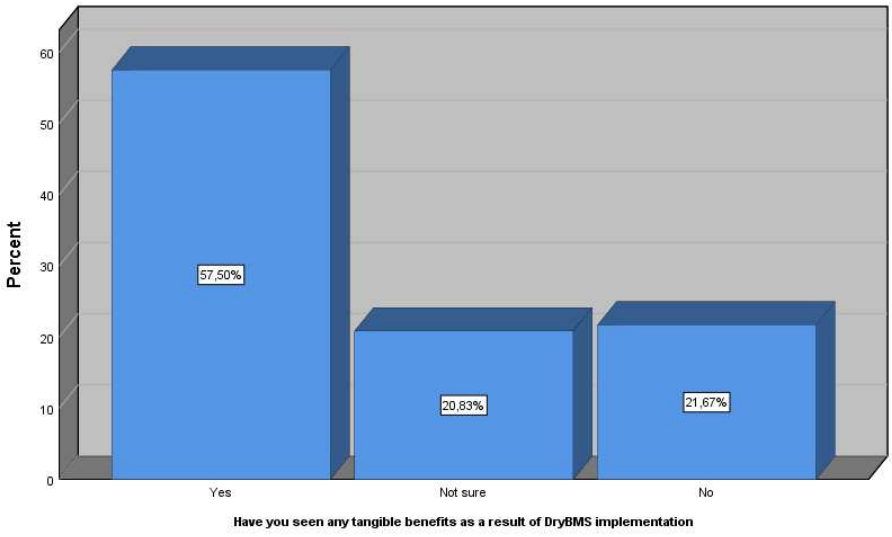


Table 11 illustrates whether organizations have provided training and education to their staff regarding DryBMS. A majority, 56.7%, have offered such training, while 43.3% have not. This distribution of responses is reflected in Graph 11.

Table 11. Has your organization provided training and education to staff related to DryBMS

		Frequency	Percent	ValidPercent	CumulativePercent
Valid	Yes	68	56,7	56,7	56,7
	No	52	43,3	43,3	100,0
	Total	120	100,0	100,0	

Graph 11. Has your organization provided training and education to staff related to DryBMS

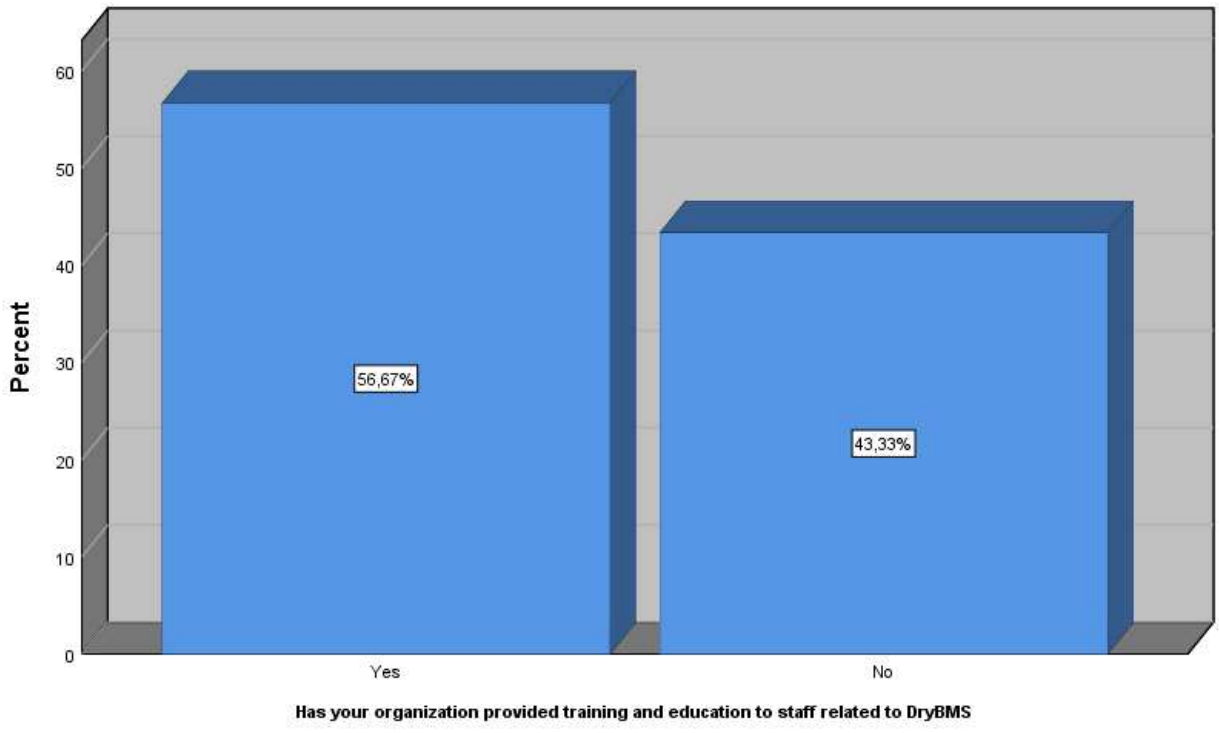


Table 12 and Graph 12 provide insights into the perceived effectiveness of training and education related to DryBMS. Among those who received training, 55.7% consider it "very effective" in improving their understanding and implementation of DryBMS. Additionally, 21.4% find it "moderately effective," while 22.9% rate it as "slightly effective." It's important to note that there is a missing data category, and the percentages are based on the valid responses.

Table 12. If yes, how effective do you consider this training in improving the understanding and implementation of DryBMS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Slightly effective	16	13,3	22,9	22,9
	Moderately effective	15	12,5	21,4	44,3
	Very effective	39	32,5	55,7	100,0
	Total	70	58,3	100,0	
Missing	-------	50	41,7		
Total		120	100,0		

Graph 12. If yes, how effective do you consider this training in improving the understanding and implementation of DryBMS

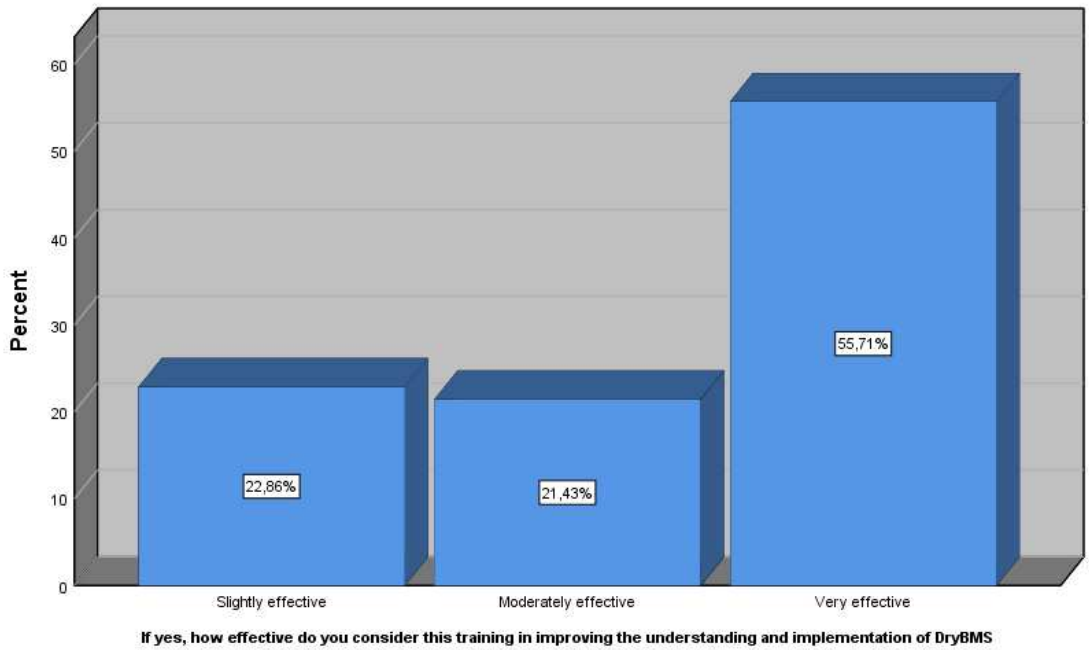


Table 13 reflects the expected evolution of DryBMS in the dry shipping industry over the next 5-10 years according to respondents. The majority, 41.7%, believe that DryBMS will "evolve to address new challenges." Additionally, 25.0% foresee it "becoming more widely adopted," while 21.7% expect it to "remain relatively unchanged." Conversely, 11.7% anticipate it "becoming less relevant." These expectations about the future of DryBMS in the industry are presented in Graph 13.

Table 13. In your opinion, how do you foresee the role of DryBMS evolving in the dry shipping industry in the next 5-10 years

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Becoming more widely adopted	30	25,0	25,0	25,0
	Evolving to address new challenges	50	41,7	41,7	66,7
	Remaining relatively unchanged	26	21,7	21,7	88,3
	Becoming less relevant	14	11,7	11,7	100,0
	Total	120	100,0	100,0	

Graph 13. In your opinion, how do you foresee the role of DryBMS evolving in the dry shipping industry in the next 5-10 years

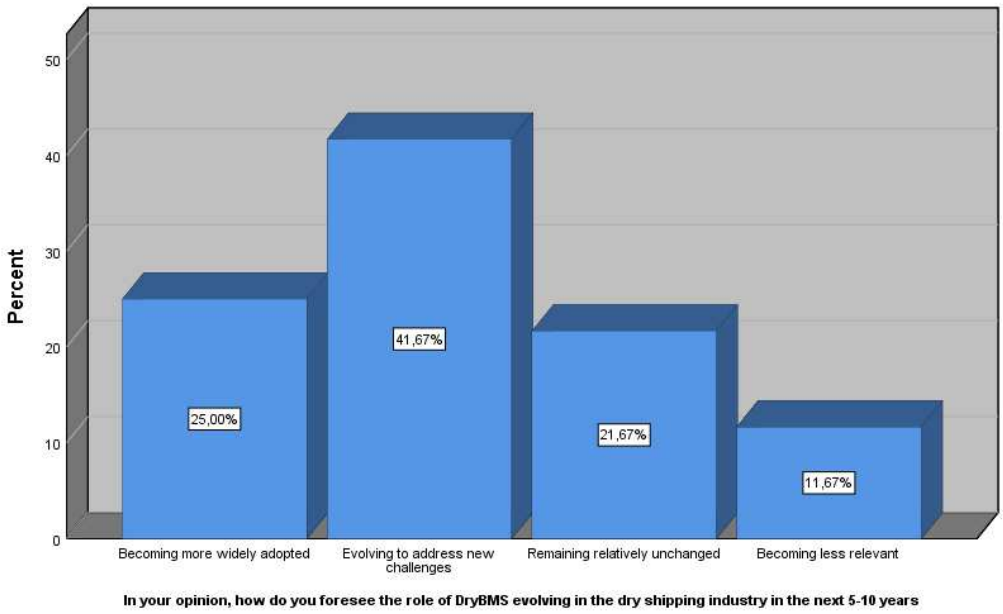
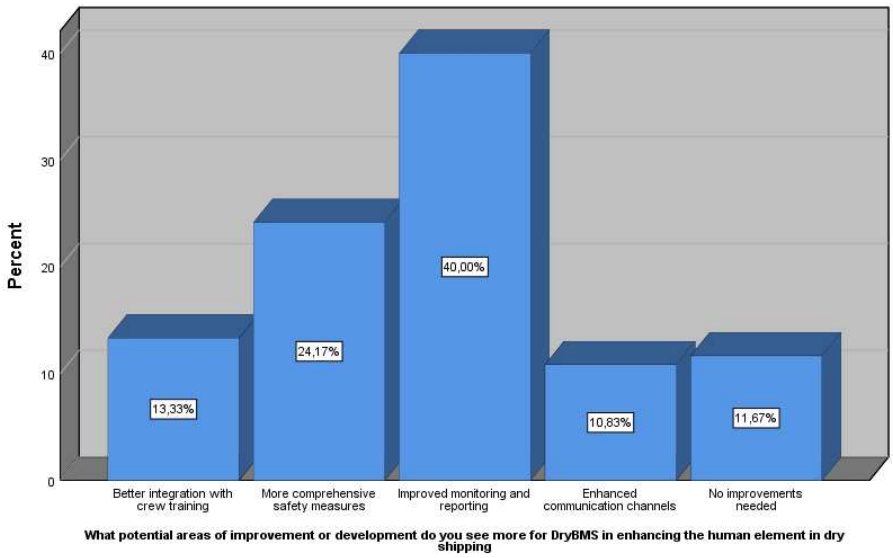


Table 14 and Graph 14 outline potential areas for improvement or development in DryBMS to enhance the human element in the dry shipping industry. The largest group, at 40.0%, sees the need for "improved monitoring and reporting." Additionally, 24.2% believe that "more comprehensive safety measures" are necessary. Another 13.3% suggest "better integration with crew training," while 10.8% advocate for "enhanced communication channels." Interestingly, 11.7% of respondents feel that "no improvements are needed."

Table 14. What potential areas of improvement or development do you see more for DryBMS in enhancing the human element in dry shipping

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Better integration with crew training	16	13,3	13,3	13,3
	More comprehensive safety measures	29	24,2	24,2	37,5
	Improved monitoring and reporting	48	40,0	40,0	77,5
	Enhancedc ommunication channels	13	10,8	10,8	88,3
	No improvements needed	14	11,7	11,7	100,0
	Total	120	100,0	100,0	

Graph 14. What potential areas of improvement or development do you see more for DryBMS in enhancing the human element in dry shipping



Discussion

Firstly, it is important to acknowledge that comparing the results of the present study with similar research in the same sector is challenging due to the recent implementation of Dry BMS. Consequently, there is a lack of appropriate research data available for comparison. Nevertheless, based on the research findings, it is evident that a majority of the respondents indicate that their respective organizations have used DryBMS, resulting in marginal enhancements or negligible alterations in their routine operational activities and decision-making procedures. This observation suggests that the implementation may be incomplete or that sufficient time has not elapsed for its comprehensive advantages to manifest in all relevant domains. Moreover, a significant proportion of participants contend that the "human factor" in land-based shipping holds great significance, as it serves to reduce the occurrence of human mistakes. Additionally, they assert that the most crucial improvement lies in the advancement of crew well-being. The wellness of the crew is a highly significant facet that demonstrates the application of optimal methodologies. Furthermore, a greater proportion of respondents assert that the primary obstacle in the implementation of DryBMS is the scarcity of resources. They concur that there are discernible advantages associated with the adoption of DryBMS, and acknowledge that their respective organizations have delivered comprehensive training and education on DryBMS, yielding highly favorable outcomes. Moving on, it appears that most of the participants believe that in the next 5 to 10 years DryBMS will evolve to meet new challenges and that the area that will be improved to enhance the human factor is to improve monitoring and reporting. Considering that the tool has undergone revisions since its initial introduction, it is highly probable that empirical studies, such as the present one, which will identify the limitations of its implementation, will contribute to substantial enhancements and modifications in the future.The initial research inquiry examined in this survey indicates that shipowners and ship managers exhibit a higher inclination towards perceiving the future of the DryBMS business as relatively stable. Furthermore, ship managers demonstrate a greater tendency to anticipate a wider adoption of DryBMS practices in the future. The majority of crew members, marine regulators, and individuals who identify their function as "Other" in the shipping industry express their support for the notion that DryBMS will undergo further development to effectively address emerging difficulties in the future. In contrast, a prevailing viewpoint among port officials is that DryBMS is likely to undergo further development in order to effectively address

emerging difficulties, or potentially diminish in significance. Therefore, it appears that the role an individual has within the transportation business has an impact on the positions they assume. Based on the second research question, it is evident that participants who received training and education from their respective organizations regarding DryBMS mostly hold the belief that its implementation has resulted in enhanced efficiency and effectively tackled issues related to resistance to change. Regarding individuals who did not undergo DryBMS training provided by their respective organizations, a significant proportion of them assert that the introduction of DryBMS resulted in a decline in safety standards. Furthermore, they encountered additional difficulties that were not documented in the survey. Hence, it is deduced that the installation of the system necessitates prior comprehensive training to effectively attain favorable outcomes.This study, similar to any scientific research, was subject to specific constraints. The most important constraint pertains to the limited sample size of participants, hence potentially limiting the generalizability of the findings.

Conclusions

The above research focused on the shipping employees' opinions about the DryBMS and the challenges of its implementation, but also the benefits it provides. The sample is consisted of 120 participants and more of them are either ship managers of crew members and have an experience in the dry shipping industry more than 10 years. Also, the majority works in Europe, while all of the participants are familiar with DryBMS.

Through the research it becomes clear that most of the participants mention that their organization implements DryBMS, which slightly improved or did not have any significant change in their daily operations and decision-making processes. Also, the majority of the respondents support that the "human element" in the dry shipping industry is very important, that it minimizes human errors and that the most important change is the enhanced of the crew's well-being. Furthermore, the participants in a higher percentage support that the biggest challenge in implementing DryBMS is the lack of resources, agree that there are tangible benefits resulting from the implementation of DryBMS and that their organization has provided training and education related to DryBMS, which was very effective. Continuing, it seems that most of the participants believe that in the following 5 to 10 years the DryBMS will evolve to address new challenges and that the area that will improve to enhance the human element is the improvement of monitoring and reporting.

The first research question reveals that the ship owners and operators more often believe that in the future the DryBMS industry will remain relatively unchanged and ship managers seem to believe more that it will become more widely adopted. As for the majority of the crew members, maritime regulators and those who choose "Other" as their role in shipping industry, support that the DryBMS will evolve to address new challenges in the future. Meanwhile, the majority of port authorities believe that in the future DryBMS will evolve to address new challenges or become less relevant. In the second research question, it seems that the participants who received training and education from their companies about the DryBMS believe mostly that its implementation improved the efficiency and faced problems by the resistance to change. As for those who did not receive training in DryBMS by their company, in their majority support that the implementation of DryBMS led to deterioration in safety and faces other challenges, than the ones mentioned in the research.

References

Adler, M. & Dumas, B. (1984). Exposure to Currency Risk: Definition and Measurement. Financial Management , volume 13 , issue 2 , p. 41 – 50.

Alamoush, A. S., Ölçer, A. I., &Ballini, F. (2022). Ports' role in shipping decarbonisation: A common port incentive scheme for shipping greenhouse gas emissions reduction. *Cleaner Logistics and Supply Chain*, *3*, 100021.

Alizadeh, A. H., & Nomikos, N. K. (2013). An overview of the dry bulk shipping industry. *The Handbook of Maritime Economics and Business*, 349-384.

Alpha Marine (2021).DryBMS: 2021 brings new challenges to Dry Bulk Sector. Retrieved from: https://alphamrn.com/dry_bms/

Amanyire, R. (2007). Safety management in shipping: an historical comparison to the state of the art. World Maritime University Disserations.

Anderson, P. (2003). Cracking the code: the relevance of the ISM code and its impact on shipping practices. London: Nautical Institute.

Bahr, N. J. (1997, 2nd Ed.). System safety engineering and risk assessment: a practical approach. Philadelphia: Taylor & Francis.

Βαζιντάρη, Ε. (2017). *TMSA-Tanker Management & Self-Assessment (Διαχείριση Δεξαμενοπλοίων και Αυτο-Αξιολόγηση)* (Doctoral dissertation, University of Piraeus (Greece)).

Ben Farah, M. A., Ukwandu, E., Hindy, H., Brosset, D., Bures, M., Andonovic, I., &Bellekens, X. (2022). Cyber security in the maritime industry: A systematic survey of recent advances and future trends. *Information*, *13*(1), 22.

Ben Ahmed, M., Molland, E., &Tomasgard, T. (2023). Challenges and Opportunities for Adopting Green Technologies in Maritime Transportation Planning. In *IFIP International Conference on Advances in Production Management Systems* (pp. 620-633). Cham: Springer Nature Switzerland.

Berg, N., Storgård, J., & Lappalainen, J. (2013). The impact of ship crews on maritime safety. *Publications of the Centre for Maritime Studies, University of Turku A*, *64*, 1-48.

Bicen, S., & Celik, M. (2023). A bibliometric review on maritime inspection analysis: Current and future insights. *Proceedings of the Institution of Mechanical Engineers, Part M: Journal of Engineering for the Maritime Environment*, *237*(2), 275-292.

Bradie, J., Rolla, M., Bailey, S. A., & MacIsaac, H. J. (2023). Managing risk of non-indigenous species establishment associated with ballast water discharges from ships with bypassed or inoperable ballast water management systems. *Journal of Applied Ecology*, *60*(1), 193-204.

Branch, A. E. (2012). Economics of shipping practice and management. Springer Science & Business Media.

Cahill, R. A. (1990). Disasters at sea: from Titanic to Exxon Valdez. London: Century Publishing.

Campbell, U. (2020).Green Technologies In The Shipping Industry. Biofriendly Planet.

Cariou, P., & Wolff, F. C. (2011). Ship-owners' decisions to outsource vessel management. *Transport Reviews*, *31*(6), 709-724.

Carter, T. (2005). Working at sea and psychosocial health problems: report of an International Maritime Health Association Workshop. Travel Medicine and Infectious Disease(3), 61 - 65.

Chistè, C., & Van Vuuren, G. (2014). Investigating the cyclical behaviour of the dry bulk shipping market. *Maritime Policy & Management*, *41*(1), 1-19.

Compass Air (2023). Part 2 – Stakeholders. Retrieved from: CompassAir | Guide to shipping - all about maritime sector stakeholders - from CompassAir, software for managing shared inboxes and maritime email collaboration (mycompassair.com)

Cox, S. J. (2007). Blackett memorial lecture: the nuclear option - human factors in safety. Journal of Operational Research Society, 58, 2-9.

Dæhli Priess, N. (2023). 4 Key Trends in the Dry Bulk Shipping Markets: Leveraging Oceanbolt to evaluate changes in cargo flows since Russia’s invasion of Ukraine, the impact of China reopening, and more. Veson Nautical.

Dai, L., Jing, D., Hu, H., Shi, Y., & Lee, S. (2023). An empirical analysis of structural breaks in world dry bulk shipping market. *International Journal of Shipping and Transport Logistics*, *16*(1-2), 141-153.

Danish Maritime Authority (2013) Survey on Administrative Burdens among International Seafarers. Final report. Kongens Lyngby: COWI.

Edu Maritime (2023).ISM Code Company Safety and Environment Protection Policy, Responsibilities and Authority. Retrieved from: https://www.edumaritime.net/ism-code/safety-environmental-policy-company-responsibilities

Franson, J. (2005). Marine safety environment management. Retrieved from www.rs-head.spb.ru/en/iseminars/is8_files/Franson_eng.rtf -

Giannelou, S. (2019). *TMSA & KPIs-The implementation and the challenges in the shipping industry* (Doctoral dissertation, University of Piraeus (Greece)).

Gold, E. (2006). Gard handbook on protection of the marine environment. Arendal, Norway: Gard AS.

Heij, C., Bijwaard, G. E., & Knapp, S. (2011). Ship inspection strategies: Effects on maritime safety and environmental protection. *Transportation research part D: transport and environment*, *16*(1), 42-48.

House, D. (2015). *Dry Docking and Shipboard Maintenance: A Guide for Industry*. Routledge.

Jacks, D. S., & Stuermer, M. (2021). Dry bulk shipping and the evolution of maritime transport costs, 1850–2020. *Australian Economic History Review*, *61*(2), 204-227.

Janzen, J. (2023). USDA and Market Analysts Agree on Key Supply and Demand Numbers. *farmdoc daily*, *13*(149).

Jayaraman, V. (2023).Human Resources can help Maritime Organizations prepare for the future. LinkedIn.

Johns, G. (1993). Constraints on the adoption of psychology-based personnel practices: Lessons from organizational innovation. *Personnel Psychology*, *46*(3), 569-592.

JOTUN (2023).Cut carbon emissions. Retrieved from: https://www.jotun.com/ww-en/industries/shipping/cut-carbon-

emissions?utm_source=google&utm_medium=cpc&utm_campaign={{campaign.name}}&utm_term={{paid.keyword}}&gclid=CjwKCAjw-KipBhBtEiwAWjgwrFecJle-uz4Q_Dn7rTE6lOC85JiAZFPUjjSrQYpcQzALTC6XK0woMxoCd8IQAvD_BwE

Kakalis, N. (2023). Bulk sector to benefit from adoption of new technologies. LR. Retrieved from:https://www.lr.org/en/knowledge/technical-articles/bulk-sector-to-benefit-from-adoption-of-new-technologies/

Karti, E. N. (2017). *Vetting and TMSA: role and requirements in the shipping industry* (Doctoral dissertation, University of Piraeus (Greece)).

Kaplan, S., & Garrick, B. J. (1981). On the quantitative definition of risk. *Risk analysis*, *1*(1), 11-27.

Lun, Y. V., Lai, K. H., Cheng, T. E., & Yang, D. (2010). Shipping and logistics management. Springer.

Marine Digital (2023).Sensors and IoT in the shipping industry. Retrieved from: https://marine-digital.com/article_sensors

Marine Insight (2022).What is Ship Management? Retrieved from: https://www.marineinsight.com/maritime-law/what-is-ship-management/

Market Research Experts (2023). Dry Bulk Shipping Market Overview 2023 and Forecast till 2030. Dry Bulk Shipping Market Report Insights

Mohammed, S.I.S. and J.G. Williamson (2004), "Freight Rates and Productivity Gains in British Tramp Shipping 1869–1950." Explorations in Economic History 41(2): 172–203.

Narendran, T., Saravanan, M. P., &Nandagopal, D. V. (2015). Design and Implementation of Smart Docking and Recharging System for Defense Robot. *IOSR Journal of Electrical and Electronics Engineering*, *10*(1), 38-41.

Noatum (2023).The role of technology in streamlining dry-docking. Retrieved from: https://www.noatum.com/en/the-role-of-technology-in-streamlining-drydry-docking/

Olesen, T. R. (2015). *Value Creation in the Maritime Chain of Transportation: The Role of Carriers, Ports and Third Parties in Liner and Bulk Shipping*. CBS Maritime.

O'Rourke, K.H. and J.G. Williamson (1999), Globalization and History. Cambridge: MIT Press.

Papachristou, A. ,Stanchev D., &Theotokas, I. (2015) 'The role of communication to the retention of seafarers in the profession', WMU Journal of Maritime Affairs. 14 (1) 159–176.

Pirozhnikov, A., &Schaminée, H. (2023). Maritime's Smart Tech Revolution. *IEEE Software*, *40*(3), 89-94.

Progoulaki, M. &Theotokas, I. (2016) 'Managing culturally diverse maritime human resources as a shipping company's core competence', Maritime Policy and Management 43 (7) 860–873.

Psaraftis, H. N., &Lagouvardou, S. (2023). Ship speed vs power or fuel consumption: are laws of physics still valid? Regression analysis pitfalls and misguided policy implications. *Cleaner Logistics and Supply Chain*, 100111.

Raptodimos, Y., Lazakis, I., Theotokatos, G., Varelas, T., &Drikos, L. (2016). Ship sensors data collection and analysis for condition monitoring of ship structures and machinery systems. *Smart Ship Technology*.

Rasmussen, N. (2023). Dry Bulk Shipping Market Overview & Outlook Q1 2023: The Way China Goes, So Goes The Market. Bimco. Copenhagen.

Redwood (2017). Dry vs Reefer LTL Shipping: Advantages and Disadvantages. Retrieved from: Dry vs Reefer LTL Shipping: Advantages and Disadvantages (redwoodlogistics.com)

Safety Culture (2022). Shipping Management: A Way to Improve the Flow of Goods. Retrieved from: https://safetyculture.com/topics/shipping-management/

Saligkara, I. (2021). Shipping Administration Risk Management in The Shipping Industry. Department of Maritime Studies, Piraeus.

Song, D. W., &Panayides, P. (2012). Maritime logistics: a complete guide to effective shipping and port management. Kogan Page Publishers.

SQE (2021).A new DryBMS standard for operational excellence for the Dry Bulk Industry. Retrieved from: https://sqemarine.com/a-new-drybms-standard-for-operational-excellence-for-the-dry-bulk-industry/

Stopford, M. (2009), Maritime Economics. New York: Routledge Press.

Theotokas I. (2018) Organization and Management of Shipping Companies. Abingdon: Routledge.

Theotokas, I. (2019).Organization and management of dry bulk shipping companies, The Routledge Handbook of Maritime Management.

Yang, C. C., Marlow, P. B., & Lu, C. S. (2009). Assessing resources, logistics service capabilities, innovation capabilities and the performance of container shipping services in Taiwan. *International Journal of Production Economics, 122*(1), 4-20.

Zaman, I., Pazouki, K., Norman, R., Younessi, S., & Coleman, S. (2017). Challenges and opportunities of big data analytics for upcoming regulations and future transformation of the shipping industry. *Procedia engineering*, *194*, 537-544.

Zainol, I., Siow, C. L., Ahmad, A. F., Zoolfakar, M. R., & Ismail, N. (2023, February). Hybrid shipyard concept for improving green ship recycling competitiveness. In *IOP Conference Series: Earth and Environmental Science* (Vol. 1143, No. 1, p. 012021). IOP Publishing.

Appendix

DryBMS : New Era in Dry Shipping and the role of human element

Section 1: Demographics

1.1. What is your current role in the dry shipping industry?

- Shipowner/Operator
- Ship Manager
- Crew Member
- Port Authority
- Maritime Regulator
- Other (please specify): _____

1.2. How many years of experience do you have in the dry shipping industry?

- Less than 1 year
- 1-5 years
- 6-10 years
- More than 10 years

1.3. Which geographic region best describes your work location?

- North America
- Europe
- Asia
- South America
- Africa
- Other (please specify): _____

Section 2: Awareness and Implementation of DryBMS

2.1. Are you aware of DryBMS?

- Yes
- No

2.2. If yes, has your organization implemented DryBMS?

- Yes
- No
- In progress

2.3. If implemented, how has DryBMS affected your daily operations and decision-making processes?

- Significantly improved
- Slightly improved
- No significant change
- Created challenges

Section 3: Human Element in Dry Shipping

3.1. How important do you believe the "human element" is in the dry shipping industry?

- Not important
- Slightly important
- Moderately important
- Very important
- Extremely important

3.2. In your opinion, how has DryBMS impacted the human element in dry shipping?

- Improved safety and well-being
- Enhanced crew training and education
- Minimized human errors
- No noticeable impact

- Created challenges

3.3. Have you observed any changes in safety, efficiency, or crew well-being since the implementation of DryBMS in your organization? Please select all that apply.

- Improved safety
- Improved efficiency
- Enhanced crew well-being
- No noticeable changes
- Deterioration in safety
- Deterioration in efficiency
- Adverse impact on crew well-being

Section 4: Challenges and Benefits

4.1. What challenges, if any, have you encountered in implementing DryBMS? Please select all that apply.

- Resistance to change
- Lack of resources
- Lack of understanding
- Regulatory hurdles
- Other (please specify): _____
- No challenges encountered

4.2. Have you seen any tangible benefits (e.g., cost savings, safety improvements, reduced incidents) as a result ofDryBMS implementation?

- Yes
- No
- Not sure

Section 5: Training and Education

5.1. Has your organization provided training and education to staff related to DryBMS?

- Yes
- No

5.2. If yes, how effective do you consider this training in improving the understanding and implementation of DryBMS?

- Very effective
- Moderately effective
- Slightly effective
- Not effective
- N/A (if not applicable)

Section 6: Future Outlook

6.1. In your opinion, how do you foresee the role of DryBMS evolving in the dry shipping industry in the next 5-10 years?

- Becoming more widely adopted
- Evolving to address new challenges
- Remaining relatively unchanged
- Becoming less relevant
- Not sure

6.2. What potential areas of improvement or development do you see for DryBMS in enhancing the human element in dry shipping? Please select all that apply.

- Better integration with crew training
- More comprehensive safety measures
- Improved monitoring and reporting
- Enhanced communication channels

- Other (please specify): _____
- No improvements needed

Thank you for your time.