Comparative Analysis Of Container Terminal Efficiency Between Libya And Egypt Using Dea Analysis

Mr. Aref Hasan Abdulla Alshabi

General Manager, Aden Port Development Company, Port of Aden.

Supervised by:

Dr. Hamza Mabrouk Ahmed Etawti

Faculty member-Higher Institute of Marine Science Technologies Sabratha.

Abstract:

Efficiency in container terminals is crucial, as it directly impacts the speed, cost-effectiveness, and overall competitiveness of global trade networks, facilitating smoother cargo flow and enhancing supply chain performance. This study aims to assess the current situation of Libyan and Egyptian terminals from 2018 to 2022 using Data Envelopment Analysis (DEA). It also seeks to provide recommendations and proposals through a clear timeline plan to enhance port efficiency. The study utilized a deductive approach to achieve its objectives. The analysis results for both Libyan and Egyptian terminals indicate that the current efficiency situation in container terminals is marked by a complex set of challenges. These terminals experience continuous congestion, inadequate infrastructure to handle increasing cargo volumes, and a lack of high operational efficiency, which leads to ship delays and slow processing of vessels and cargo. Additionally, heightened security concerns, such as theft and terrorism, further

exacerbate the situation by increasing insurance costs and causing additional delays. Moreover, administrative, and bureaucratic procedures contribute to the overall complexity of port operations in Libya.

Keywords: Efficiency, Container Terminals, Libya, Egypt, Data Envelopment Analysis.

1. Introduction:

The maritime transport industry is one of the most important pillars of the growth of the national and international economy, especially for maritime countries, as ports represent the main gateways to countries, which obliged countries to develop measures and policies to raise the efficiency of their seaports to suit the requirements and requirements of the standards necessary for their operation, in the era of technology and competitiveness. Therefore, it has become necessary to work on developing ports, creating added value, strengthening their competitive position with their counterparts in the same region, improving the business environment surrounding the port industry, addressing the elements of competitiveness, being the optimal solution to fulfill its national mission and reach high productivity, developing plans and strategies that ensure the exploitation of the local competitive advantage, to upgrade it inside and outside the region, and following modern scientific measures and methods through studies and research to identify the elements affecting

operation and management, and activating the appropriate means to address its obstacles (Ismail, 2019).

Measuring the efficiency of container terminals is a vital aspect in the field of logistics and cargo transportation. It is an essential element to ensure an efficient and smooth flow of goods in the supply and transport chain. Thanks to this measurement, companies and organizations can achieve greater efficiency and cost savings, thereby increasing their competitiveness (Gökçek and Şenol, 2018). But the importance of measuring the efficiency of container terminals goes beyond economics, they play a vital role in achieving the goals of sustainable development and environmental conservation. Improving transport and distribution processes' environmental sustainability makes it possible to preserve the environment and reduce negative impacts on the planet. In addition, the efficiency of container terminals contributes to saving customers time and increasing their satisfaction, which strengthens trade relations and promotes economic growth.

2. Literature Review

Previous research on port efficiency has extensively explored various dimensions impacting the operational effectiveness of ports. This section will review previous studies on port efficiency.

2.1 Previous studies concerned efficiency around the world:

Hsu et al. (2023) undertook an examination of the operational efficiency of container terminals within the Kaohsiung Port, employing DEA as a primary empirical method. Given the pivotal role of container terminals within the maritime transport ecosystem, their operational efficiency significantly influences the overarching efficacy of port operations. The study's research problem centers on identifying a suitable approach for appraising the operational efficiency of container terminals within the Kaohsiung Port context. To address this, the research employs regression analysis to discern the determinants affecting the operational efficiency of these terminals, including factors such as terminal size, technological sophistication, and managerial practices.

Baştuğ (2023) utilized the DEA-SCOR model to assess the operational efficiency of Turkish container ports. This model combines Data Envelopment Analysis with the Supply Chain Operations Reference (SCOR) model and was applied to twenty-three seaports. The study incorporates input variables such as container berth, wharf length, number of Ship-to-Shore (STS) cranes, and number of MHC cranes, with TEUs serving as the output variable. The findings reveal significant disparities in operational efficiency among Turkish container ports. Some ports operate above the efficient frontier, while others lag. Key

determinants of operational efficiency include port size, geographical location, and the adoption of technology.

Efecan and Temiz (2023) assessed the technical efficiency of container ports within the Mediterranean and Black Sea regions for the period 2017 to 2019, emphasizing the crucial role of efficiency in enhancing their global trade competitiveness. Utilizing a non-monotonic inefficiency effects model, the researchers analyzed the relationship between outputs (TEUs), physical inputs (total terminal area, berth length, and vessel handling equipment), and external inefficiency factors. Their findings indicate that advanced levels of automation are significant contributors to inefficiencies within these ports.

The findings of (Danladi et al., 2024) indicated that the predominant source of technical inefficiencies in container ports within Low and Middle-Income (LMI) countries is attributable to pure technical inefficiencies rather than scale inefficiencies. Moreover, the analysis reveals that the most efficient ports are typically those that are both large and serve as hubs. Interestingly, the data also suggest that larger ports, as defined by throughput, do not inherently demonstrate greater efficiency compared to smaller-scale ports.

Ismail and Elbayoumi (2024) follow a deductive approach, employing DEA models, specifically the CCR model, and sensitivity analysis (SA) to identify the most influential variable affecting the efficiency scores of the main Egyptian container

terminals. According to the sensitivity analysis, draft emerges as the most significant variable impacting efficiency scores. Utilizing the CCR model, the research reveals that, except for the East Port Said terminal, the majority of the Egyptian container terminals assessed during the study period exhibit inefficiency. The scope of the study is confined to evaluating the technical efficiency of six Egyptian container terminals: Alexandria, El-Dekheila, Damietta, East Port Said port, Port Said West, and El-Sokhna terminals. These assessments are conducted using two distinct DEA models over the timeframe spanning from 2018 to 2022.

2.2 Previous studies concerned efficiency in Libyan and Egyptian container terminals:

Ismail and Wanis (2019) conducted a comparative analysis aimed at evaluating the operational efficiency of the top ten container ports in Egypt and Libya. The objective was to delineate their respective strengths and weaknesses and to pinpoint the underlying reasons for inefficiency. This endeavor was intended to enhance the competitive positioning of these ports within the regional landscape. To this end, the authors employed a comprehensive review of existing literature to explore various theoretical frameworks, methodological approaches, and the breadth of research concerning port efficiency. Their findings offer valuable insights for port managers regarding the adoption of innovative technologies and the strategic investment in both infrastructure and superstructure to bolster port efficiency.

Furthermore, the study introduces a methodological framework using the Data Envelopment Analysis (DEA) Charnes, Cooper, and Rhodes (CCR) model to measure the technical efficiency of container ports and terminals, a framework that applies to other container ports globally.

Tabet et al., (2020) evaluate the performance of North African container ports and terminals by examining their overall, pure, and scale efficiencies. For this purpose, panel data including various input and output variables related to the infrastructure and superstructure of North African container ports were analyzed for a shipping cycle from 2014 to 2018. The study utilized basic DEA models to assess and rank the efficiencies of these ports and terminals. The findings indicate that many North African container terminals are facing inefficiencies.

Eltwaty et al., (2022) aim to measure the efficiency of Libyan container terminals using Data Envelopment Analysis for the period between 2010 and 2020, to identify weaknesses area to make recommendations to enhance the efficiency of these ports between its neighboring ports in the Mediterranean. The DEA-CCR analysis showed that the port of Malta Freeport achieved full relative efficiency in 2018 only, while the port of Damietta came close to achieving it in 2019, and the Libyan ports were the least efficient among all ports using this model, and that the average overall efficiency during the study period using the DEA-CCR model was at 0.070, which is very low. As for the

DEA-BCC analysis, it showed that the ports of Tobruk, Khoms, and Damietta achieved full relative efficiency during the entire study period, being ports that are not huge and that the port of Giutauro was the least efficient using this model, and that the average overall efficiency of the BCC DEA model is at 0.803. The results showed that the Libyan and neighboring container ports market is non-competitive and that most of the ports and container terminals in the study area are ports that are not technically competent, although they have experienced a slight improvement in their performance during the study period.

The next Figure 1. shows the research gap and research contribution.

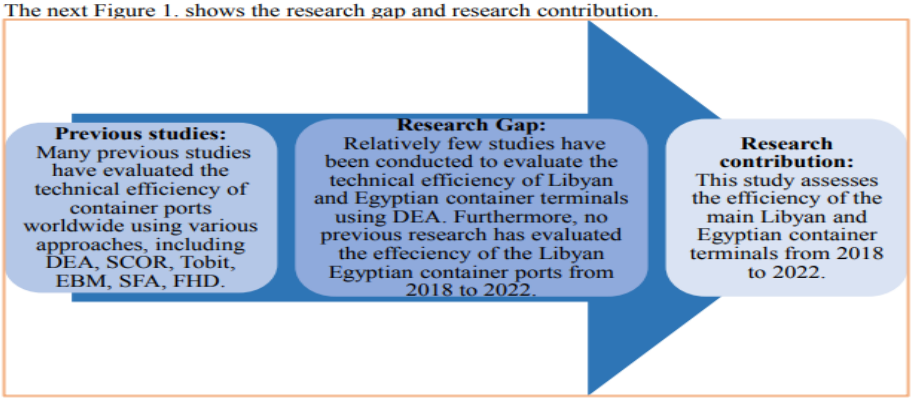

Figure 1. Research gap and contribution.
Source: Authors' elaboration.

From the above Figure 1. We found that few studies have been conducted to evaluate the technical efficiency of Libyan and Egyptian container terminals using DEA. This study assesses the efficiency of the main Libyan and Egyptian container terminals from 2018 to 2022.

3. Research Problem:

Libyan ports face a set of challenges that significantly affect their operational efficiency. One of the most prominent of these challenges concerns the political and security stability in the country, where the ongoing conflict and the lack of stability pose a major obstacle to the organization of daily operations at the ports. Security threats and maritime crime risks come as another challenge, exposing the marine environment surrounding ports to security challenges that affect the agenda and efficiency of services. Moreover, reports indicate that there is a lack of infrastructure in some ports, which hinders the effectiveness of operations and leads to delays in loading and unloading cargo. From other aspects, complex bureaucratic procedures appear as a factor hindering the smooth running of processes, as delays in administrative and customs transactions can lead to increased shipping costs and reduced efficiency.

4. RESEARCH AIMS AND OBJECTIVES:

The study aims to assess the current situation of the Egyptian and Libyan ports during the study period. As well as providing recommendations and proposals through a clearly defined time plan to improve the efficiency of ports. While the research objectives are:

- To assess and evaluate the efficiency score of the Libyan and Egyptian container terminals from 2018 to 2022.

- To provide recommendations aiming at strengthening and increasing the efficiency of resources used in the Libyan and Egyptian container terminals.

5. Research Importance:

As global participation and logistics dynamics rapidly evolve, the significance of studying port efficiency has never been more pronounced. The efficiency of seaports is emerging as a critical concern, given its direct correlation with handling costs. Nations with inefficient seaports typically incur higher handling expenses, establishing a clear inverse relationship between port efficiency and service charges. Moreover, the quality of infrastructure in a country influences its port costs, with nations boasting robust infrastructure often enjoying lower port expenses. Consequently, efficiency stands as a paramount consideration in contemporary port economics, accentuated by a port's strategic role in national communication networks.

6. Research Methodology:

There are many methods used to measure efficiency, but Cullinane and Wang (2010) stated that DEA has emerged as one of the most important methods for measuring efficiency. Due to its ability to compare multiple independent input/output parameters. In recent years, this technique has sometimes been applied to the port industry, more specifically, to the container terminal. Elsayeh, (2015) advocates the need to use DEA to measure port performance. It has been used in many studies. Data

envelope analysis is a technique for measuring the efficiency of the functioning of many different types of entities engaged in many different activities with different inputs and outputs. It was also used (Emrouznejad, 2014) to measure how efficiently the station uses the available resources to generate a set of outputs.

Many researchers have studied the efficiency of container ports from the perspective of management methodologies Data Envelope Analysis (DEA) is considered and many studies have used DEA-CCR such as; Polyzos and Niavis, 2013; Almawsheki and Shah, 2015; Tabet et al., 2020; Ismail and Elbayoumi, 2024.

DEA is a non-parametric method that uses linear programming to measure the relative efficiency of a set of units of a homogeneous nature, called decision-making units (DMUs) and was developed by (Charnes et al.,1978) in other words, the analysis of the data envelope is based on the use of linear programming to create an envelope or a field containing data so that the production efficiency of different facilities can be estimated according to the combination of resources used in this field, which represents a symmetrical production curve.

Many criteria measure efficiency, and those criteria are used in the DEA model, and those criteria are the port area, design capacity, handling equipment, cranes, length of berths, depth of berths, submersible, and many other criteria are used to measure the efficiency of ports. Many researchers consider DEA to be the most effective approach to measuring a set of key performance

indicators. The DEA tool stands out as an ideal tool for efficiency assessment due to its non-parametric nature, enabling it to accommodate multiple outputs without the need for preconceptions about the relationships between inputs and outputs. This technique proves especially valuable in the processing of port efficiency measurement (Ismail and Elbayoumi, 2024).

Storage area has been used as an input variable in several previous studies that applied DEA analysis to measure efficiency at container terminals, such as Morini et al., 2014 ؛Nguyen et al., 2015; Elsayeh, 2015; Ismail, 2019). The terminal area has been used as an input variable in several studies such as Almawsheki and Shah, 2015: Hlali, 2018, Elsayeh, 2015; Ismail, 2019. In addition, berth length has been used as an input variable in many studies such as Kutin et al., 2017; Cabral and Ramos, 2018; Hlali, 2018; Elsayeh, 2015; and Ismail, 2019. Berth depth has been used as an input variable in many studies such as Cabral and Ramos, 2018 Hlali, 2018; Elsayeh, 2015; and Ismail, 2019.

To measure the technical efficiency of major container terminals in Libya and Egypt for the period between 2018 and 2022; four inputs were used namely the Cranes, Berth Depth, Berth length, and Design Capacity.

The design capacity of the port is meant to be the maximum number of tons of cargo that the port can handle. The length of the berths refers to the total length of the pier used for docking

and unloading ships, as the pier is an essential part of the port structure and is used for loading, unloading, and ship maintenance. The length of the berth is usually measured in meters or feet. The size and capacity of the port depend on the length of the pier and its ability to accommodate a number and different sizes of vessels, and the length of the pier has a significant impact on the efficiency of loading and unloading operations at the port. As for the depth of the berths, it refers to the sea depth of the waters surrounding the pier where ships are moored and unloaded.

The depth of the berth is generally measured in meters. The available berth depth is important to ensure safe and efficient access of ships to the port. Cranes refer to cranes or cranes that are used to lift and move heavy cargo in the port, and these cranes play a crucial role in loading and unloading ships and transporting containers and cargo between ships and ground facilities in the port. TEUs are the standard container unit of measurement, a unit of measurement used to measure the volume of containers in the shipping industry. It refers to the size of a standard 20-foot container, which is one of the common sizes of containers.

The study relies on the secondary data collected by the researcher, analyzed using the CCR model via the MAX DEA Lite program (V.12.0.8) to assess the efficiency of container terminals under study. Only five years is chosen since the average shipping market cycle is

5 years (Stopford, 2009). This research is limited to the year 2022 due to the unavailability of official and authorized data for Libyan container terminals for the year 2023.

7. Empirical Analysis:

The efficiency of the Libyan ports was compared with the Egyptian ports because the Egyptian ports are one of the closest ports to Libya and they are similar in shipping lines as well as geographical location.

Before calculating the efficiency of ports, the highest value (Maximum), the lowest value (Minimum), the average (Average), as well as the standard deviation (SD) must be calculated for the data of the ports under study during the year 2022, and the following Table 1. shows these calculations:

Table 1. Maximum, Minimum, Average, and Standard Deviation of selected criteria.

	TEUs	Cranes	Berth Depth	Berth length	Design Capacity
Maximum	3246353	76	19	2400	5400000
Minimum	59	1	7	350	2000
Average	712371	27	13	1535	1178000
SD	1037217	24	3	605	1645670

Source: Authors' elaboration. (Using Microsoft Office – Excel).

According to the calculation of the metadata, we find the highest value in the above data in the design area amounted to 5,400,000

Panama, which amounted to 2,400 in the length of the sidewalks, 19 meters in the depth of the sidewalks, while it reached 76 in the number of awnings and finally the number of goods in circulation amounted to 3,246,353 TEUs. The lowest value in the above data was represented by the design area amounted to 2000 Panama, which amounted to 350 in the length of sidewalks, 7 meters in depth of sidewalks, while it reached 1 in the number of Cranes, and finally, the number of goods in circulation amounted to 59 TEUs.

As for the median of the above data, in the design area, it reached 1,178,000 Panama, it reached 1,535 in the length of the sidewalks, 13 meters in the depth of the sidewalks, and it reached 27 in the number of awnings. Finally, the number of goods in circulation reached 712371 TEUs. While the standard deviation of the data in the design area amounted to 1,645,670 Panama, it amounted to 605 in the length of the berths, 3 meters in the depth of the berths, while it reached 24 in the number of Cranes, and finally, the number of goods in circulation amounted to 1,037,217 TEUs. The following Table 2. shows the market share of the container terminals under study.

Table 2. Market share of container terminals under study.

Container terminals	TEUs	Market share percent	Total percent
East Port Said port	3246353	50.63%	50.63%
Damietta	1152318	17.97%	49.37%
Alexandria	839952	13.10%	
El-Dekheila	710707	11.09%	
Port Said west	274743	4.29%	

Misrata	**141443**	**2.21%**	
Al Khums	**23582**	**0.37%**	
Tripoli	**22185**	**0.35%**	
Tobruk	**59**	**0.00%**	
Total	**6411342**	**100 %**	

Source: Authors' elaboration. (Using Microsoft Office – Excel).

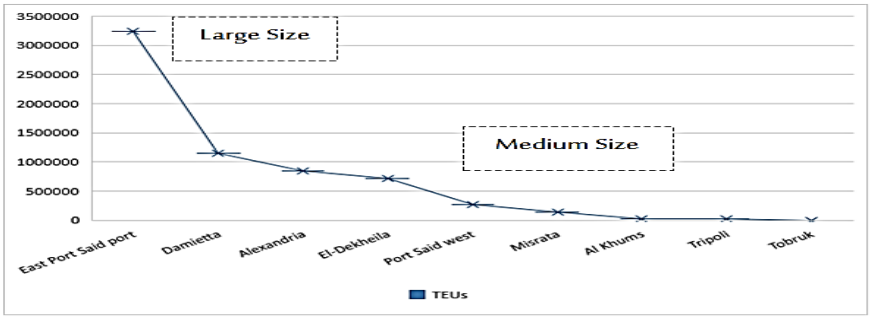

Figure 2. TEUs of the ports under study in the year 2022.
Source: Authors' elaboration. (Using Microsoft Office – Excel).

The technical efficiency of container terminals in Libyan and Egyptian ports was calculated using the CCR model via the MAX DEA Lite program (V.12.0.8), using the last five years ' data for those ports. In the analysis of the efficiency of container terminals, it was found that no container terminal in Libyan ports received a unit efficiency score of (1) during the study period from 2018 to 2022. Even though the port of Misrata did not achieve the efficiency score of Unit (1), it was ranked as the best port in Libya during the study period.

Table 3. shows the lack of efficiency of any of the Libyan ports, as it shows that the port of Misrata is the most efficient, despite this, its efficiency did not exceed 0.5 during the studied time

cycle. In 2022, although the efficiency has improved to 0.562, this indicates that the port's resources are not being fully utilized. The efficiency of the port in 2018 was recorded at 0.562, in 2019 it decreased to 0.429 and then continued to rise until it reached 0.562 in 2022. The port of Al Khums under study was ranked in terms of efficiency, with a ratio of 0.347 in 2018, and increased to reach 0.361 in 2019. In 2020, its efficiency reached 0.371, and in 2021 it reached 0.376. And in the end, it fell again in 2022, reaching 0.333. These changes in efficiency scores indicate fluctuations in the performance of Al Khums Port over the years, as there can be various influences on the factors affecting its efficiency, be it an improvement or a decrease in the use of available resources.

Table 3. The efficiency score of container terminals under study.

Libyan container terminals	2018	2019	2020	2021	2022
Tobruk	٠.٠٢١	0.026	٠.٠٣٦	0.007	0.001
Tripoli	٠.٣٠١	0.365	٠.٣٩٨	٠.٣٧٨	٠.٥١١
Misrata	٠.٤٢٨	٠.٤٢٩	٠.٤٥٨	٠.٥٣٢	٠.٥٦٢
Al Khums	٠.٣٤٧	٠.٣٦١	٠.٣٧١	0.376	0.333
Egyptian container terminals	**2018**	**2019**	**2020**	**2021**	**2022**
Alexandria	0.935	0.997	1.000	0.895	0.984
El-Dekheila	0.970	1.000	0.871	0.738	0.738
Damietta	0.839	0.761	0.746	0.775	0.841
East Port Said port	0.718	0.856	1.000	0.955	0.925
Port Said west	0.893	1.000	0.763	0.643	0.420

Source: Authors' elaboration.

Speaking about the neighboring container terminals, namely the Egyptian container terminals, the technical efficiency of the

Egyptian container terminals was calculated, it was found that the container terminals at Alexandria Port achieved an efficiency score equivalent to Unit (1) in 2020, while Dekheila Port achieved the same achievement in 2019. The eastern port of Port Said and Port Said also showed the same result in 2020. In contrast, Damietta Port did not achieve a unit-equivalent efficiency score during the studied period.

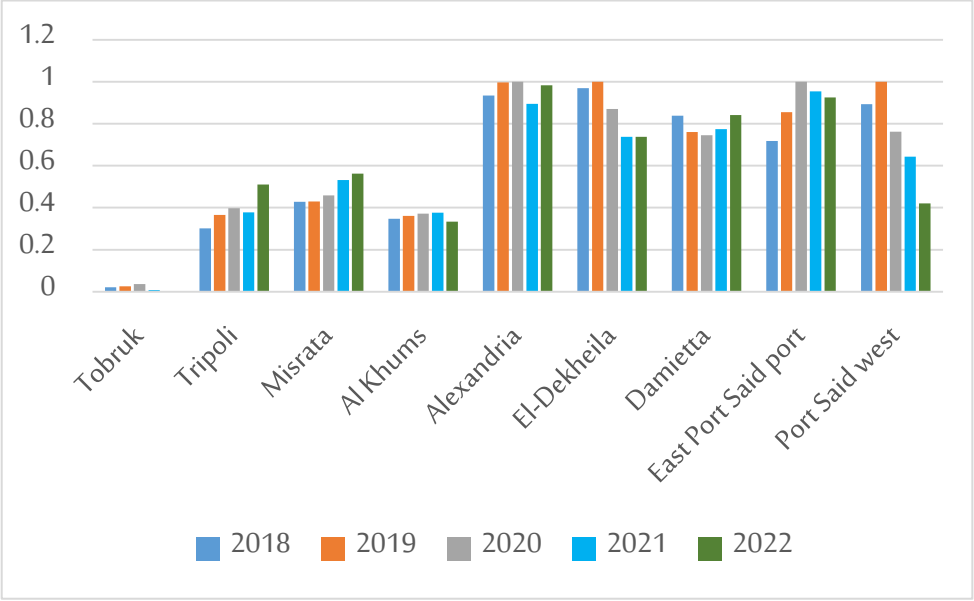

Figure 3. Measuring the efficiency of Libyan and Egyptian container terminals.

Source: Authors' elaboration. (Using Microsoft Office – Excel).

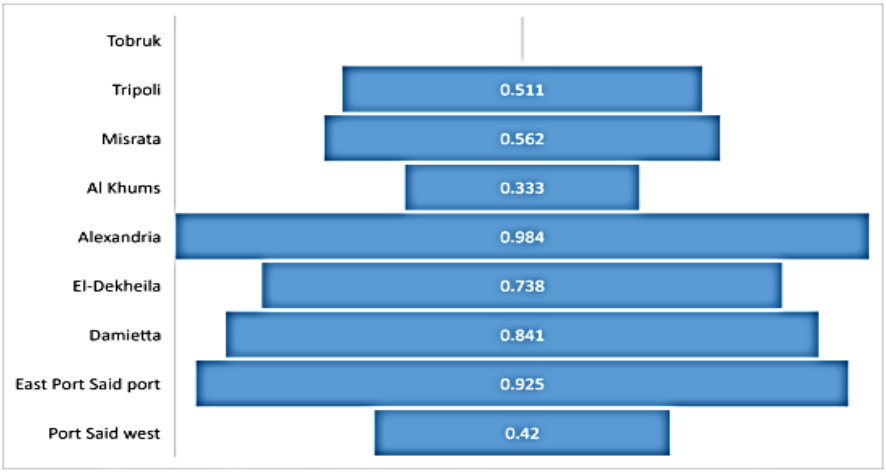

Figure 4. Efficiency of Libyan and Egyptian container terminals.
Source: Authors' elaboration. (Using Microsoft Office – Excel).

The results of the analysis were found for both Egyptian and Libyan ports, but the worst and least efficient ports among the ports under study are the Libyan ports as shown in Figure 5. The study found that the current efficiency situation at Libyan and Egyptian container terminals is characterized by a complex set of challenges. These terminals are faced with constant congestion, insufficient infrastructure to cope with increasing cargo volumes, lack of high operational efficiency leading to ship delays and slowness in ship and cargo handling procedures.

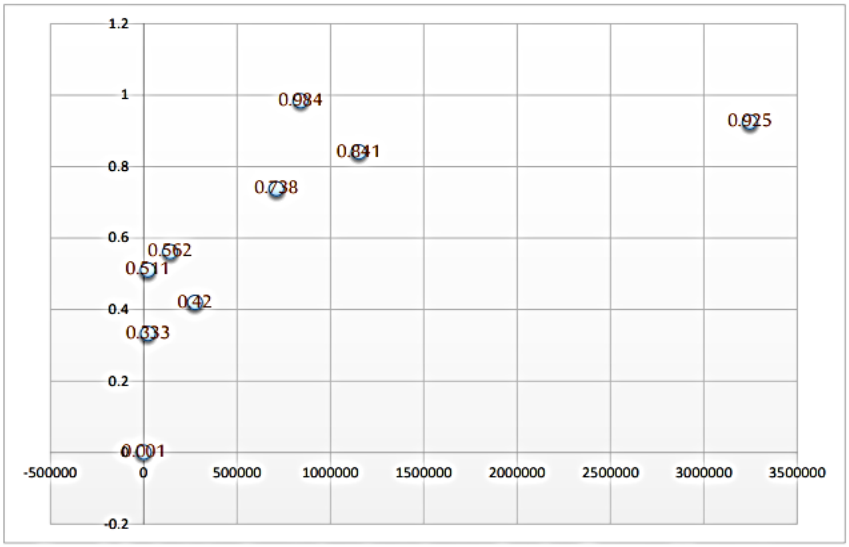

Figure 7. Productivity of terminals under study, as well as the efficiency of those ports. Source: Authors' elaboration. (Using Microsoft Office – Excel).

For Libyan ports, there are more security concerns, such as theft and terrorism, to aggravate the situation by raising insurance costs and causing further delays. Moreover, bureaucratic procedures contribute to the overall complexity of port operations. The inefficiency of container terminals in Libya is because all ports and terminals in Libya are experiencing a deterioration in their operational efficiency due to the significant challenges they face that negatively affect their efficiency and performance. The people working at these ports are coping with these challenges with great difficulty, but the unstable political and economic situation in Libya has severely affected the ability to deal with these problems. The following is a review of some of

the most important problems experienced by Libyan ports that hinder their efficiency:

- Libyan ports suffer from permanent political instability and internal conflicts. This makes it difficult to stabilize transportation and logistics processes and significantly increases the level of uncertainty.
- Libyan ports are suffering from a lack of funding and investment needed to improve infrastructure and equipment. This leads to obsolescence of facilities and negatively affects efficiency and performance.
- Ports in Libya face challenges in terms of management and regulation. Lack of effective planning, supervision, and control can lead to a waste of resources and an increase in costs.

The researcher has developed a time plan to raise the efficiency of Libyan terminals because all terminals suffer from a lack of operational efficiency in those ports. It is represented by the following Table 4.

Table 4. Mechanisms enhancing Libyan terminals.

Responsible entity	Mechanisms of application	Time frame
Al Khums Port (Administration in the port of Al Khums)	The administrative systems of Al Khums port can be developed and modernized through: • Restructuring the Department according to a transparent and accountable governance system. • Appointing qualified and experienced human cadres in Port Management. • Adopting an integrated management information system to facilitate port operations. • Simplification of administrative and customs procedures to speed up the smooth movement of ships and goods. • Expanding the provision of logistics services within the port to reduce transportation costs . • Organizing continuous training courses for port workers to raise their efficiency. • Establishing partnerships with international ports to exchange experiences and modern technologies. • Encouraging investment in Port support activities such as logistics services. • Applying international quality standards and safety systems in the management of port operations. • Establishing the principles of governance, transparency, and equal opportunities in port management.	One year
Al Khums Port (Infrastructure in the port of Al Khums)	Modernizing the infrastructure of the Al Khums seaport in Libya by: • Laying and paving roads inside the Al Khums port. • Development of entry and exit gates. • Develop squares to increase the number of stacks. And for the reception of refrigerator containers. • Expansion and deepening of the navigational Basin and jetties to accommodate more ships. • Construction of a new container terminal equipped with modern technological means to speed up loading and unloading operations. • Development of anchors for Al Khums Seaport. • Provide environmentally friendly and competitive services to users. • Expansion of cargo and container storage spaces and equipping them with the necessary equipment. • Developing the infrastructure of roads, bridges, and lighting systems inside the port. • Installation of modern technological systems for monitoring and controlling the movement of ships and cargo.	Five Years

	• Providing logistics support facilities and services such as customs clearance and shipping services. • Training and qualification of human cadres to operate the port following best practices. • Enhancing the security and safety of the port through advanced systems. • The use of "blockchain" technology (Blockchain), transparency, and the need to pay attention to cyber security at the port of Al Khums, especially the seaports in Libya.	
Ministry of Transport	The establishment of partnership agreements with leading international shipping companies could greatly enhance maritime activities in Libya. By entering into these partnerships, Libya can draw upon the expertise and resources of these global firms to upgrade its port infrastructure and advance its logistics and maritime transport sectors. Such contracts are also pivotal in boosting maritime trade and expanding the volume of trade exchange with international markets. This, in turn, supports the growth of Libya's national economy and reinforces international cooperation in maritime transport.	One Year
Laws	• Review legislation to attract local and international investments by granting tax and Customs incentives. • Establish a legislative framework that responds to the needs of all members of the Al Khums port community, through amendments to laws to keep pace with developments in the maritime transport industry. • Develop laws and instructions that clarify rights, duties, and responsibilities. • Allocating resources and support for research programs and technological projects, the state can support innovation and the development of new products and services, which will enhance the diversification of the economy and increase the country's competitiveness in global markets. In addition, it can contribute to the creation of new jobs and increase the level of knowledge and experience in multiple fields."	One Year

Source: Authors' elaboration.

8. Conclusion

The results of the analysis for both Egyptian and Libyan ports concluded that the current efficiency situation at the Libyan and Egyptian container terminals is characterized by a complex set of challenges. These terminals are faced with constant congestion,

insufficient infrastructure to cope with increasing cargo volumes, lack of high operational efficiency leading to ship delays and slowness in ship and cargo handling procedures. In addition, further security concerns, such as theft and terrorism, aggravate the situation by raising insurance costs and causing further delays. Moreover, administrative, and bureaucratic procedures contribute to the overall complexity of port operations.

The results also indicate that most of the studied Egyptian container terminals suffer from inefficiency during the period from 2018 to 2022, because of multiple challenges such as geopolitical conflicts, the impact of the COVID-19 pandemic, and the Russian-Ukrainian war. These challenges affected the economy, investments, Security, and shipping networks, which led to a negative impact on the efficiency of container terminals in that period. Propose areas for further research, such as longitudinal studies to assess the impact of implemented improvements over time or expanding the study to include other forms of maritime terminals to get a broader perspective of the maritime industry in North Africa.

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