Journal of Shipping and Ocean Engineering 10 (2020) 1-17
Doi: 10.17265/2159-5879/2020.02.001

Determining a Framework for Ports Performance in Egypt

Capt. Ahmed Shaheen
Arab Academy for Science, Technology & Maritime Transport (AASTMT), Egypt

Abstract: In recent times, ports competition is rising sharply in the global maritime sector. This research aims to introduce a performance measurement system to evaluate and enhance maritime ports and in particular the performance of Egyptian ports. It explores the factors that may affect the ports' performance. The proposed paper would help ports decision makers to evaluate ports performance, determining areas that require improvement, and ultimately allocating the funds needed to develop and enhance ports performance. Data is collected from the official websites of the Egyptian ports for year 2019. The paper includes 15 ports: (Alexandria, Dekhela, Damietta, Port Said, Arish, East of Port Said, Suez, Petroleum Basin, Al Adabia, Sokhna, Hurghada, Safaga, El Tor, Nuweiba, and Sharm El-Sheikh). The literature is reviewed, and a descriptive analysis is conducted to determine the significant indicators for assessing port performance. By the end of this paper, results are demonstrated on how the proposed factors affect the performance of ports. It is concluded that performance is measured by Total Area, Number of Platforms, Length of Platforms and Depth of Platforms. It is concluded that Port of Suez has the best performance among the other 15 ports in 2019 from the total area perspective. While Port of Alexandria is the leading performer in 2019 according to number of platforms perspective, length of platform perspective and depth of platform perspective.

Key words: Ports, Egypt, performance, productivity, containers.

1. Introduction

Egypt has a very unique geographical location on the major trade paths between Europe and the Far East, surrounded on the north by the Mediterranean Sea with three main ports, namely Alexandria, Damietta and East Port Said, and on the east by the Red Sea and Sokhna port. Since 2000, the Egyptian government set policies which targets of enhancing the Egyptian exports and attracting regional and international markets for container handling, transient and transshipment [1]. As a result, the researcher in this paper focuses on analyzing the performance of the main ports of Egypt and determine the factors which may influence their performance. The aim of this paper is to discuss the ports' performance, factors affecting ports' efficiency. The paper would help ports decision makers to evaluate ports performance, determining areas that require improvement, and ultimately allocating the funds needed to develop and enhance ports performance.

This paper is structured into six main parts: 1) Introduction, which gives the first spot light on the research topic; 2) Literature Review to formulate the research gape analysis 3)port performance and factors influence and drivers of performance 4) Methodology, which defines the methods used to obtain the data and analyze the selected ports' sample; 5) Descriptive Analyses, in which the data is analyzed and represented in diagrams; 6) conclusion and Contribution, which represents the gap that the current paper attempts to fill and represents the findings of the analysis and interpretation of the ports' responses. 7) Recommendation.

2. Literature Review

The concept of a "port" has evolved over the years from a simple, modal point of exchange of goods

Corresponding author: Capt. Ahmed Shaheen, Lecturer; research fields: port management and operation. E-mail: ahmedshehno77@yahoo.com.

(land-sea) to a link in the global supply chain. Port studies have developed in parallel, gradually targeting the port logistics chain, moving beyond the port's typical boundaries [2].

Seaports are complex and dynamic entities; also, they are different from one another, where various operations are performed out by and for the account of different actors and institutions. Ports are very distinct in terms of their assets, roles, systems and institutional organization, and the operations or services conducted are broad in scope and nature even within a single port. Moreover, port roles and functions are defined from geographic, economic, political and social viewpoints [3].

Port administration examines have concentrated for the most part on ports' competitiveness and proficiency. Notwithstanding, instruction for supportability management and preparing is step by step turning into a significant piece of courses in the business colleges of European and American colleges and universities. Subsequently, maintainable transportation and distribution frameworks have become a vital component in the worldwide logistics industry. As per the UK's Department of the Environment, Transportation and the Regions, a feasible distribution framework ought to incorporate the accompanying eight targets.

To enhance the productivity of distribution; limit emissions and decrease ozone depleting substance emanations; diminish commotion and unsettling influence from cargo developments; oversee advancement pressures on the scene (both regular and artificial); and lessen the quantity of mishaps, wounds and instances of sick wellbeing related with cargo development. Also, it has been found that port performance is linked with the efficiency of distribution [4].

This paper is designed to discuss the ports performance, factors affecting and their implications on ports efficiency. The first section discusses the factors affecting the ports performance.

3. The Port Performance

Ports have customarily assessed their performance by matching their real and ideal throughputs. In case of a port's real throughput moves toward its ideal throughput after some time, the result is that its achievement has improved over the long run. When the port registers low performance, for example, high compartment abide time, risk of vessel defers extra charge most exceedingly terrible still is the enormous ships not using the port. Over the long run this renders transport from the port not competitive by truthful investigation. Crane efficiency which is determined per crane and can be communicated in gross and net qualities. Port efficiency and productivity, there are many distinctive profitability and productivity estimates which terminal administrators need to process, despite the fact that they may wish to incorporate others for monitoring their profitability. These center profitability measures such as: Ship efficiency which is the broadest proportions of ship efficiency relate compartment dealing with rates for a ship's call to the time taken to support the vessel [5].

Also, the port has been considered to assume a significant role as a basic hub in worldwide supply chain exercises. It is broadly accepted that the ports structure a significant relationship inside the whole worldwide trade chain. The port is a segment of the merchandise distribution framework since it offers an interface among oceanic and land inside business traffic. Lately, port performance indicators have been enhanced in different studies, especially in connection to port capacities in logistics. In a viewpoint that can be adjusted to logistics performance hypothesis, port performance has been noted about its mix into the worldwide supply network by utilizing different measures and factors. Port performance could be estimated from an efficiency, productivity, financial, budgetary, social and client fulfillment point of view. Productivity, profitability and finance points of view are each situated towards finance and proficiency. While social and client fulfillment point of view

center around efficiency, considered from the viewpoint of port stakeholders [6].

There are several factors components can influence port performance in the present competitive condition, including nearby market attributes, authoritative and physical capacity, coordinated capacities in logistics frameworks, terrestrial and oceanic (maritime) availability, competition (rivalry), dock gear and stopping (parking) field, conveyance administration and association with the hinterland zones. Correspondingly, brings up that in the present time of worldwide supply chains, notwithstanding cargo (freight) throughput, there may likewise be other substantial and helpful measures for port performance, for example, slackness, nimbleness, agility, and pressure time and different parts of performance in the supply network. Adequacy, effectiveness, efficiency, and proficiency perspectives ought to likewise be utilized in estimating port performance, which is typically connected with effectiveness in operational exercises, as far as quantity, and in asset use [5].

Metalla et al. (2015) [7] identified the most significant port performance indicators to discuss port operators and the management efforts to improve overall port efficiency. The study was held in Albania. A survey was developed in order to weigh the importance of each port performance indicator. According to the respondents' view, the most important performance factor was "port condition". Shallow ports represent one of port users and operators' most significant concerns. International market features, Area size and Security monitoring systems are other performance indicators that respondents highly valued.

Port and conveyance services, infrastructure, foundation, port membership, and market direction additionally including components influencing port performance. Therefore, factors affecting ports performance are physical characteristics, ship frequency, transport recurrence, port and dock infrastructure, working time, productivity, profitability, and information frameworks become different factors in deciding port performance. Port exercises are constrained by ship services, area, availability, information frameworks, efficiency, productivity, esteem, and port networks. The significance of reach ability to the hinterland regions has affected port performance. Identified with this, additionally recognizes that geographic area and physical qualities are remembered for the key performing criteria of the ports. From an alternate perspective, the specialization is recognized as a port performance factor mirroring the rate of port improvement, from mechanical stage to business arrange, and mirrors the scale and agglomeration impacts of the port and its effect on performance [6].

Comprehensively, ports are worked and managed under the various types of port organization and proprietorship. Some ports are constrained by central government in a manner that incorporates all guideline and landowner works; some are worked under blended public and private assistance arrangement. In some countries, ports are, as a rule, private associations being completely privatized with all administrative and operational capacities moved from general society to the private area and expecting to amplify benefits with diminished financial investment and venture. Despite the administration structure of ports, a definitive goal of any port is to amplify and maximize operational profitability, efficiency, and productivity, and to enhance generally overall immediate (direct) and circuitous (indirect) monetary benefits and economic advantages. The mechanism of this lie in accomplishing operational proficiency and financial stabilization, and in building supportable income streams inside a particular asset base and spending plan [8].

From one viewpoint, the idea of sustainability has been distinguished as one of the key variables affecting the improvement of port competitiveness, then again sustainability is required to evacuate or limit hazard, minimize risk, surrendering momentary

additions characteristic in, such as investing extra investment and reducing environmental costs. Consequently, sustainable economic and financial development is one of the basic agendas for port agencies (authorities), and a continuous discussion has been centred around the harmony among natural and social concerns, and economic significance. In any case, it is a complex undertaking to asses performance or determines assessment criteria in that performance itself is weaved with a large number of internal and external factors and components. This multifaceted nature has added to creating assorted quantitative pointers to evaluate performance with regards to ports, and to weight them through devices and assessment techniques including Environmental Management Systems, and manufactured index computation strategies [8].

Evaluating port performance has needed to represent correlative and multidimensional methodologies with view to deciding the economic adequacy of maintainability destinations. For instance, it could be concentrated on the socio-economic effects of port exercises, while it has been investigated the connection among economic and ecological (environmental) performance of ports. So, in the next section, the researcher will demonstrate the main factors and drivers of ports performance.

3.1 Factors Affecting Ports Performance

Port performance and port decision are among the most well-known themes with regards to port investigations and studies. Notwithstanding this, they have generally been treated by analysts as two separate surges of work. Subsequently, port performance estimation and measurement have deficiently improved from the viewpoint of port decision. This hampers the endeavors of ports to compete effectively and to envision on conceivable future changes in port decision by shippers and transporters. Up to this point, different viewpoints than port decision has overwhelmed the writing on port performance. For instance, performance incorporated the economic productivity, efficiency, effectiveness, and viability of a port, services to domestic clients of the port or the administration of the association. If a port is chosen all the more as often as possible for a specific hinterland locale, it will have a bigger piece of the overall industry (market share) and is then viewed as more competitive than a port that is chosen less every now and again for that equivalent hinterland district [9].

Organizations, for example, port agencies and port terminal administrators utilize diverse performance the management methods to acquire understanding into the quality, cost-adequacy, profitability, and productivity of their activities. Performance conveys a proficiency part concerning how well the assets consumed are utilized and, in this regard, ports and terminals change contributions to a procedure into yields. In the literature, remote ocean compartment port and holder terminal performance as far as productivity have been considered widely. Some researchers actualized panel data approaches so as to have the option to execute medium-and long run effectiveness examination. They found that proficiency levels of compartment ports fluctuate (some of the time definitely) after some time. This implies port and terminal performance consequences of non-panel data must be treated with care. Different researchers examined a data collection of 20 ports on port performance by applying information envelopment investigation [10].

In their findings, they concentrated on the overall rankings of the ports toward one another. Others discovered that scale economies exist at the compartment terminal level in holder ports. A later discovering is from some researchers. In their investigation of Norwegian holder ports, they claim that the ports need to expand their scale because of the compartment port tasks performing under expanding returns to scale. On the other hand, some researchers demonstrated a model to investigate port competition

for the coordinated multi-purpose arranges plan and pricing system issue. Their primary decision and conclusion join dry port areas unmistakably with geology. While, other constructed a logistics network and supply chain practices to deal with port performance assessments. The structure they created can be gainful for port effectiveness by concentrating port strategies on exercises that produce the most included an incentive in logistics network and supply chains [10].

Ha and Yang (2017) presented a half and half multi-partner system for the demonstrating of port performance measurements. The structure offers a symptomatic instrument for performance assessment of terminals and ports. In spite of the fact that they consider the diverse port stakeholder to quantify port performance, the partners do exclude various kinds of clients and the weighting of these measures isn't acquired from partners, yet from topic specialists.

On the other hand, Metalla et al. (2015) [7] examined five classifications of port performance factors which are: port condition, operational conditions, equipment, service quality, and management quality. As per the respondents see, the most significant exhibition factor from the principal bunch "port conditions", was esteemed normal states of the port. In case of a shallow port, this reflects one of the most significant worries for port clients and administrators. Elements of the universal markets, is another performance element that respondents weighted more. Some ports are struggling to turn into a progressively territorial ports and concentrating on these capacities will make ports increasingly competitive. Also, region size is another significant performance factor. This is the performance factor that respondents gave the most significance. Some ports are "encompassed" by the city and there is no space for ports expansion. Security monitoring frameworks is another performance indicator that was profoundly esteemed from the respondents. Security stays a lasting worry for port operators and Administration.

Also, Lirn et al. (2013) [4] tried to evaluate the green performance indicators of three significant ports in the Greater China area. The results demonstrate that "air emission management" was the most significant measurement impacting these ports' green performance, trailed by "fluid contamination administration", "solid waste and different toxins management", "tasteful and noise control committee", and "maritime protection". The findings discoveries propose that the port and terminal administrators ought to supplant their diesel quay cranes, transtainers, forklift trucks, straddle bearers and the other apparatus with electrically determined models. Electrically determined trucks and machines can't just adequately lessen green gas emanations, yet in addition they can generally diminish the degree of commotion produced by customary diesel motors. According to the previous section, the ports performance is one of the main concerns for research and investigation. Thus, in next sections will illustrate the port performance and achievements that could happen if performance is improved.

3.2 Drivers of Ports Performance

Port administration performance is a significant issue in ebb and flow transport policy. Ports are, truth be told, the foundation of universal and international trade since over 90% of the worldwide development of freight is seaborne [11]. They demonstrate the hubs of the worldwide system of associations, relating long term routes to national and domestic transport and logistic frameworks. The present outlook and the expanding globalization of the economies are calling for higher productivity and efficiency from all factors of transport and, particularly ports, where there is utilization of public input to their production procedures. Besides, the expanding cooperation of private partners in managing ports or significant a proportion of them (whole terminals) and the passage of new ports on the scene, totally financed by public money in nations with lower budget limitations

regarding generally maritime ones, have expanded the competitive weights in the entire segment. In this manner there is a need to identify the drivers of ports performance [12].

4. Methodology

The current paper seeks to identify and empirically test the factors that may have an impact on the port performance and efficiency. Therefore, the researcher in this paper compares between some selected ports using certain performance and efficiency criteria. So, the sample frame is the Egyptian ports. A sample of 15 ports was selected based on factors that may influence the ports' performance such as (space, platforms, capacity and sidewalks of containers). This type of selection is entirely non-random rather than it is called purposive sampling in which the researcher deliberately selects these cases which, in his point of view, will best serve the goal of his research study. The data is collected from the official websites of Egyptian ports. Then, a descriptive analysis is conducted to the collected data. The following section demonstrates the descriptive analysis performed.

5. Descriptive Analyses

Descriptive Analysis is performed for the collected data. Data is collected from the official websites of the Egyptian ports for year 2019. The paper includes 15 ports: (Alexandria, Dekhela, Damietta, Port Said, Arish, East of Port Said, Suez, Petroleum Basin, Al Adabia, Sokhna, Hurghada, Safaga, El Tor, Nuweiba, and Sharm El-Sheikh). The data is divided into two main groups: Egyptian ports overview and Egyptian container terminal. The analysis for each is demonstrated below.

5.1 Egyptian Ports Overview

First, starting with Egyptian ports overview which includes: area including; (land area, water area and total area) and total number of platforms, including; (container terminals area, quays length, and the depth of the quay).

5.1.1 Ports area

Area of ports is one of the important factors to consider ports performance. The total area of the port can be divided into a land area and a water area.

5.1.2 Land Area

The area is the quayside area and as shown in Fig. 1 is a comparison between the land areas of the ports. It could be noted that East of Port said has the biggest land area while El Arish has the smallest land area.

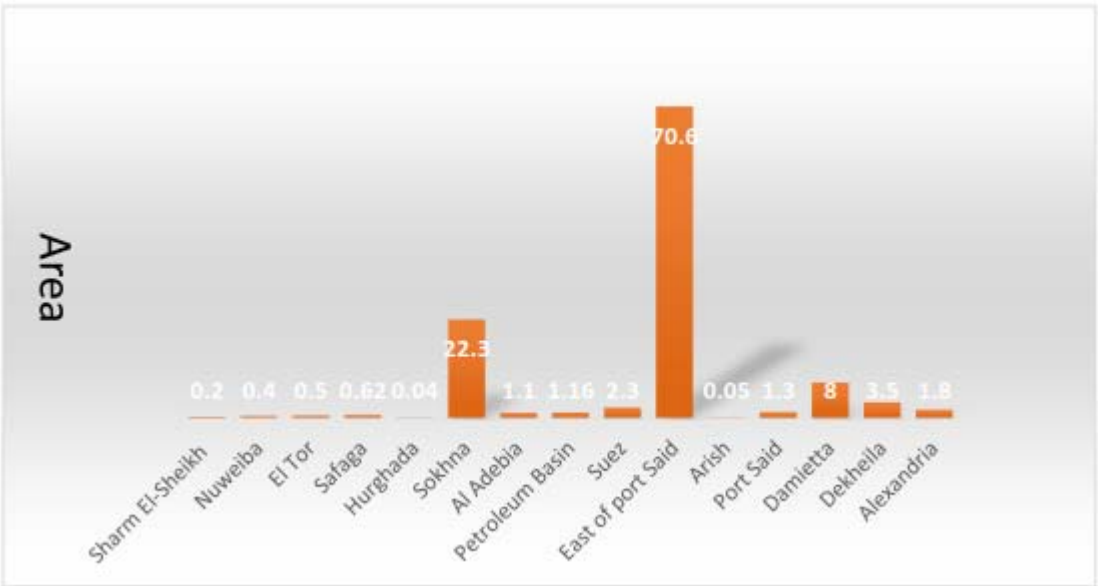

Fig. 1 The land area of ports in Egypt.

5.1.3 Water Area

The water area is the sea area owned by the port as shown in Fig. 2, which shows a comparison of the water areas of the ports. It could be noted that Suez has the biggest water area while Arish, Al Adabia and El-Tor do not have any water area.##

5.1.4 The Total Area

The total area of the port is a land area and a water area as shown in Fig. 3 comparing the total areas of the period where, Suez has biggest total area while Arish, Al Adebia, Petroleum basin and El Tor have no total area.

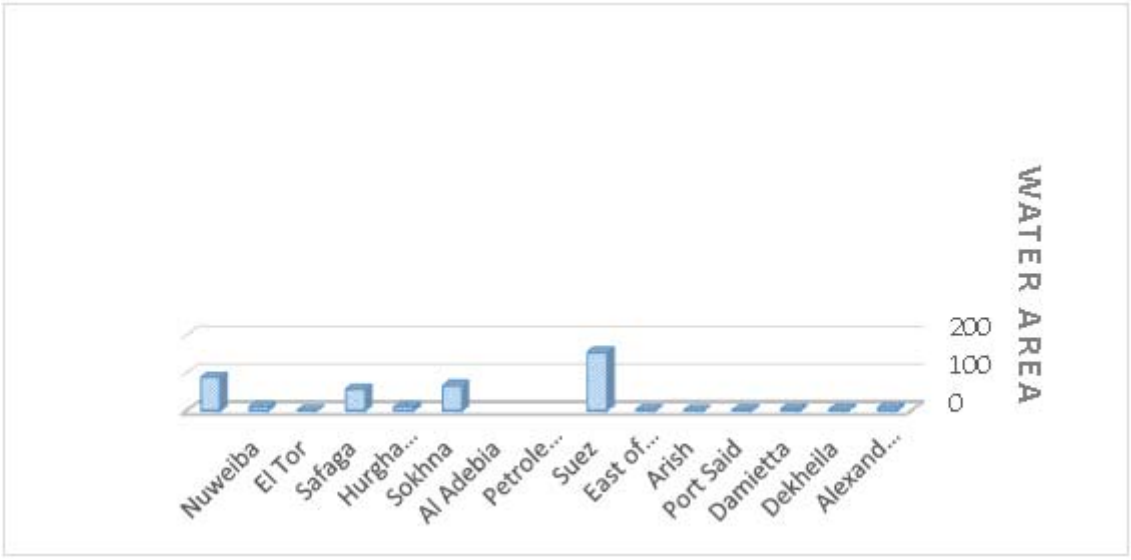

Fig. 2 The water area of the ports.

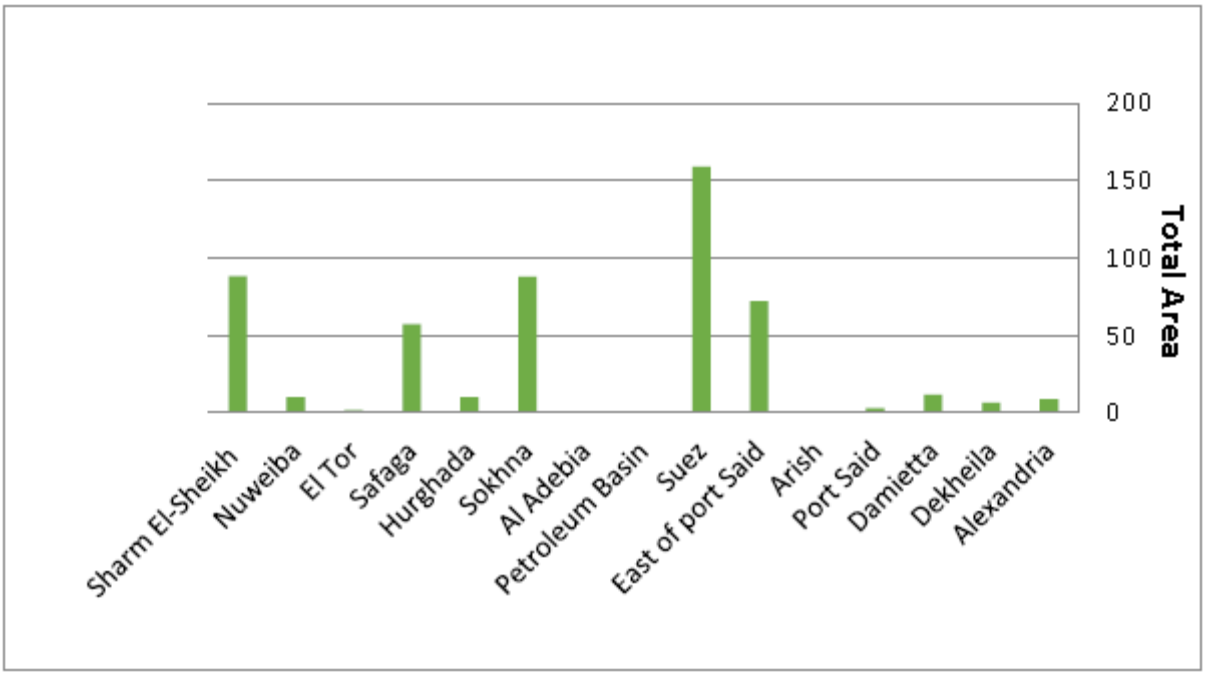

Fig. 3 The total area of ports in Egypt.

5.2 Total Platforms Including Containers Quays

In this section, a comparison will be made between all platforms including the container sidewalks in each of the sidewalks setting, quays length, and the depth

of the sidewalks

5.2.1 Total Number of Platforms

Fig. 4 shows the total number of platforms in the ports. It can be noted that the biggest number of platforms is 64 and the smallest number is 1.

5.2.2 Lengths of Platforms

Fig. 5 shows the difference between the lengths of the sidewalks (m2) in each port, we can conclude that Alexandria has the highest length of platforms while El Tor has the smallest length of the platforms.

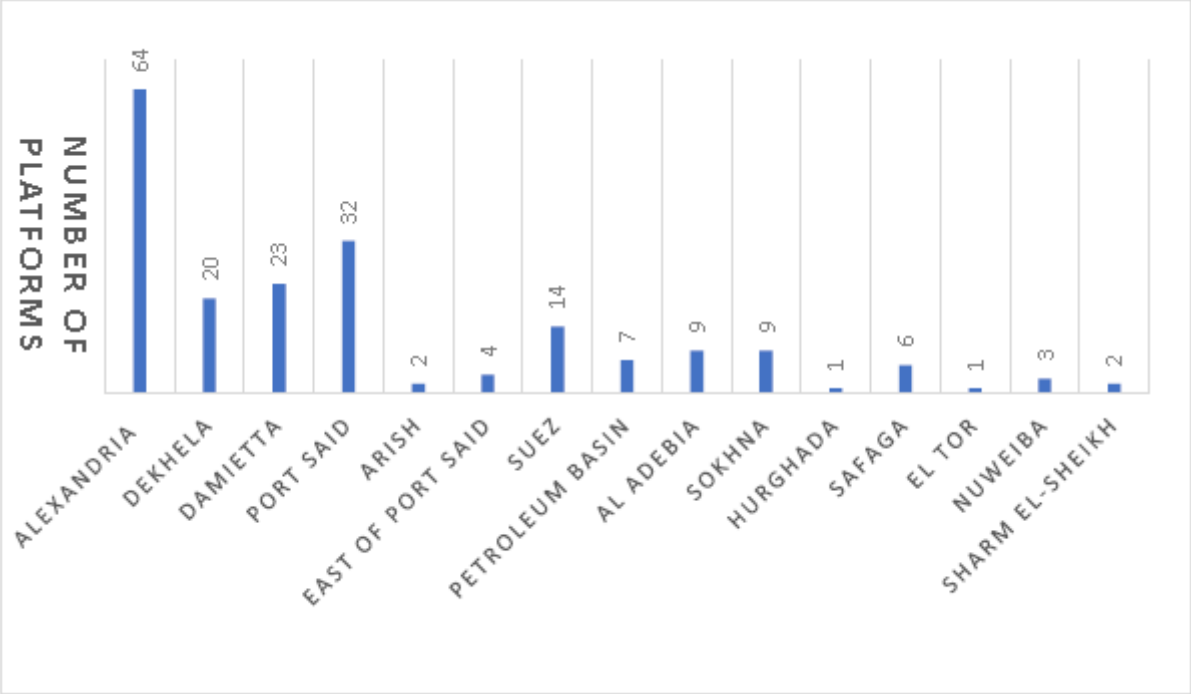

Fig. 4 Number of platforms per port.

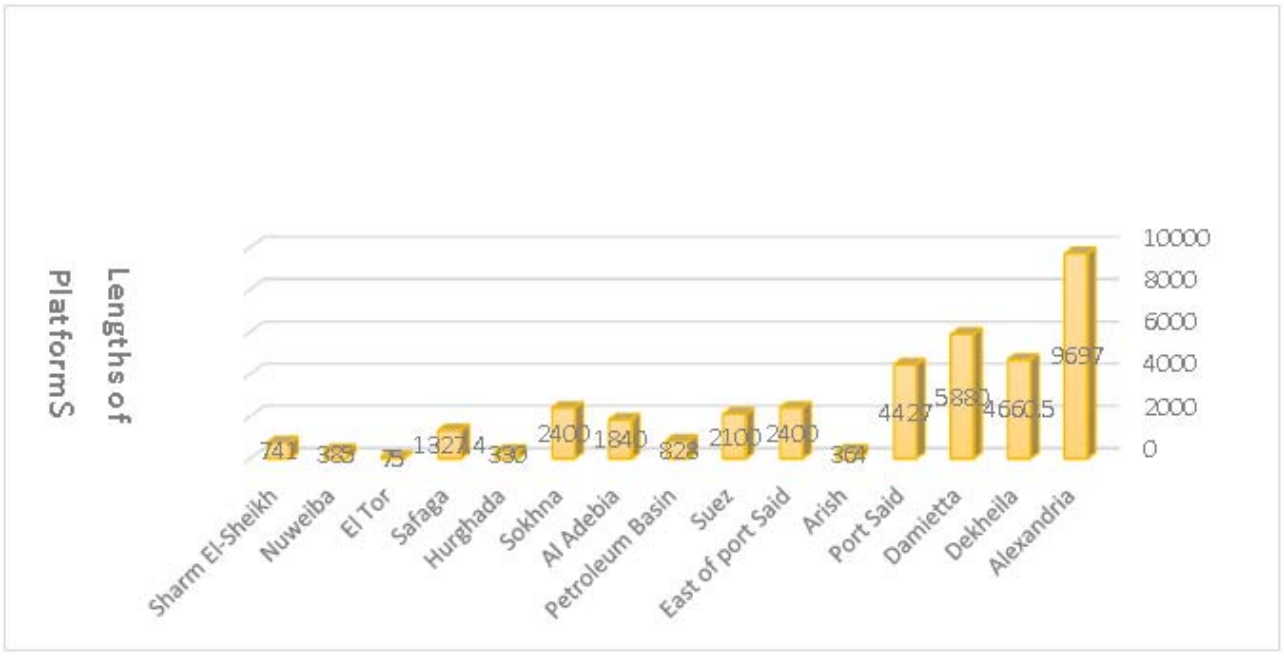

Fig. 5 The lengths of the platforms in the ports.

5.2.3 The Platforms Depth of Each Port

Fig. 6 compares the depth of each of the ports (m^2). As we see Dekheila has the deepest port while El Tor has the shallowest port.

5.3 Egyptian Container Terminal

The second group is Egyptian container terminal includes maximum design power including (goods at the port and number of containers) and sidewalks of container including (number of quays of container, quays of containers lengths and container's platforms depth).

5.3.1 Maximum design Capacity

The design capacity of the port is divided into two types of general goods per year by one million tons and the number of containers per million containers per year

5.3.2 Goods at the Port

The goods are measured per million tons per year as shown in Fig. 7: Alexandria has the highest number of goods while Hurghada and Sharm El-Shaikh have no number of goods.

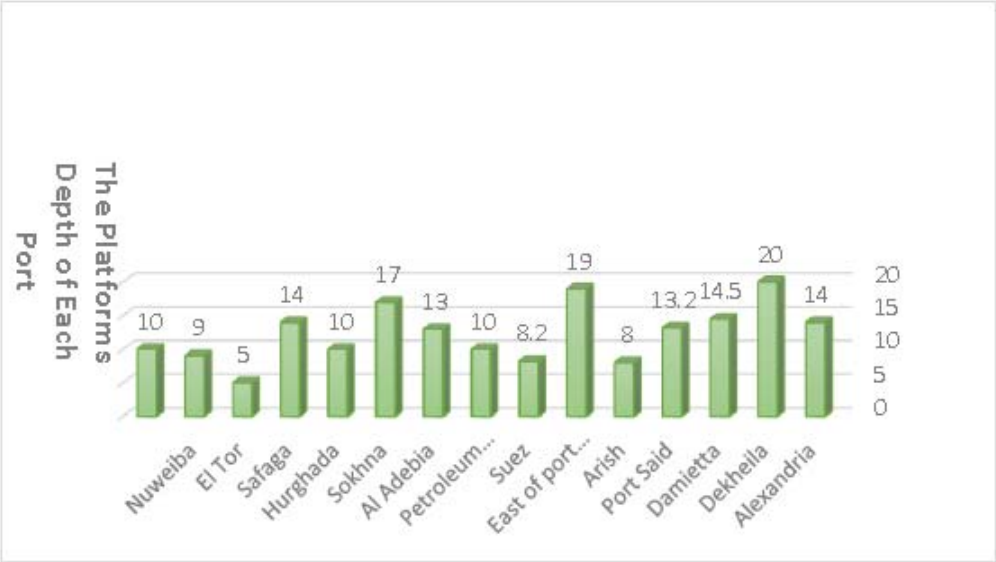

Fig. 6 The Sunken (depth) platforms in each port.

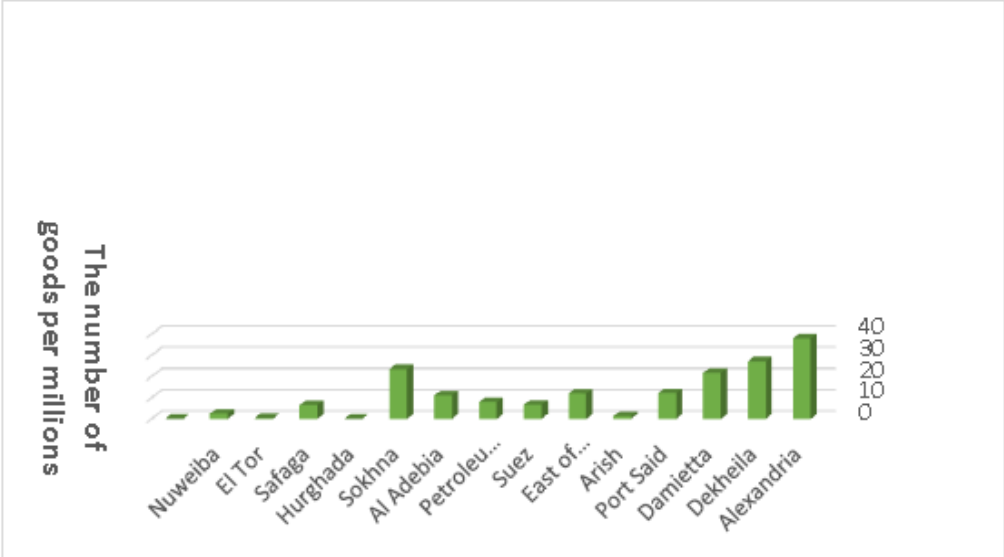

Fig. 7 The number of goods per million per year for the ports.

5.3.3 Number of Containers

The number of containers per year is measured in million tons as in Fig. 8: we can conclude that East of Port Said has the biggest number of containers while Al-Areesh, Suez, Petroleum Basin, Al Adabia, Hurghada, Safaga, El-Tor, Nuweiba and Sharm El-Sheikh have no number of containers.

5.3.4 Platforms of Container

These platforms accommodate containers only at each port.

5.3.5 Number of Quays of Container

Fig. 9 shows the number of container Platforms in each port as we can see that Dekheila has the biggest number of Quays of container while Suez, Petroleum Basin, Al Adebia, Hurghada, Safaga, El Tor, Nuweiba and Sharm El-Sheikh have no number of Quays of container.

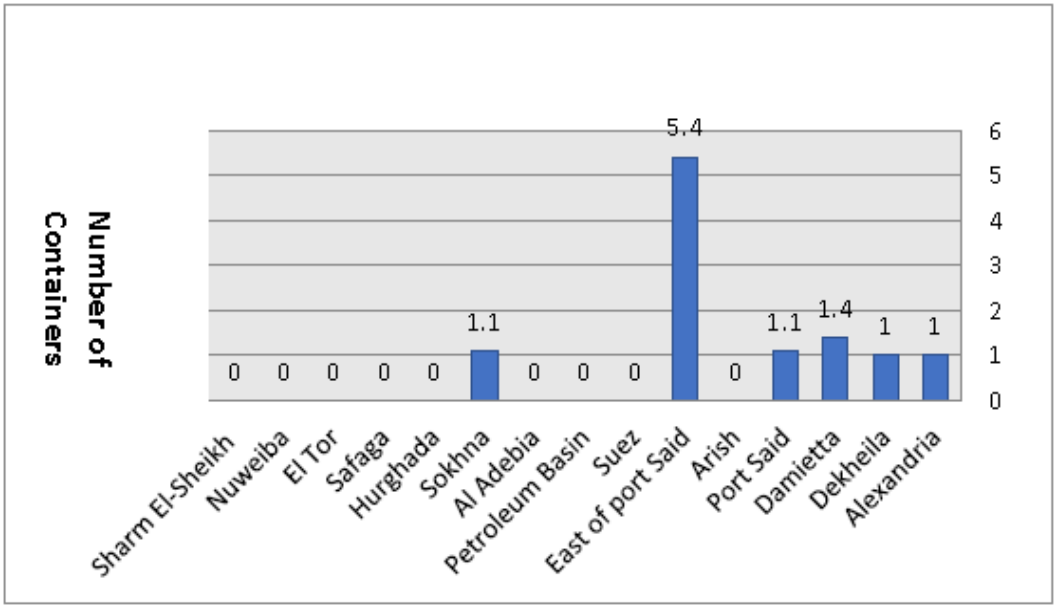

Fig. 8 Number of containers in million.

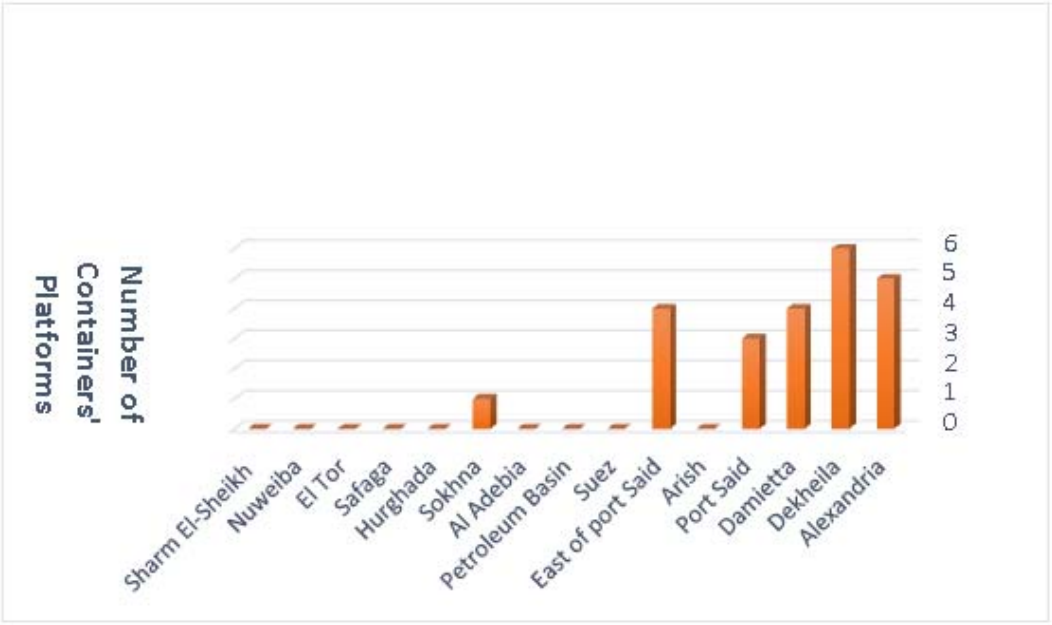

Fig. 9 Number of container platforms.

5.3.6 Quays of Containers Lengths

Fig. 10 shows container sideways lengths for ports (m^2), we can note that East of Port Said has the highest length of platform containers while Al-Areesh, Suez, Petroleum Basin, Al Adebia, Hurghada, Safaga, El-Tor, Nuweiba and Sharm El-Sheikh do not have any length of container platforms.

5.3.7 Container's Platforms Depth (m^2):

Fig. 11 shows the depth of each container sidewalks in each port we can see that East of port said has the deepest platforms of containers while Al-Areesh, Suez, Petroleum Basin, Al Adebia, Hurghada, Safaga, El-Tor, Nuweiba and Sharm El-Sheikh do not have any depth of platforms of containers.

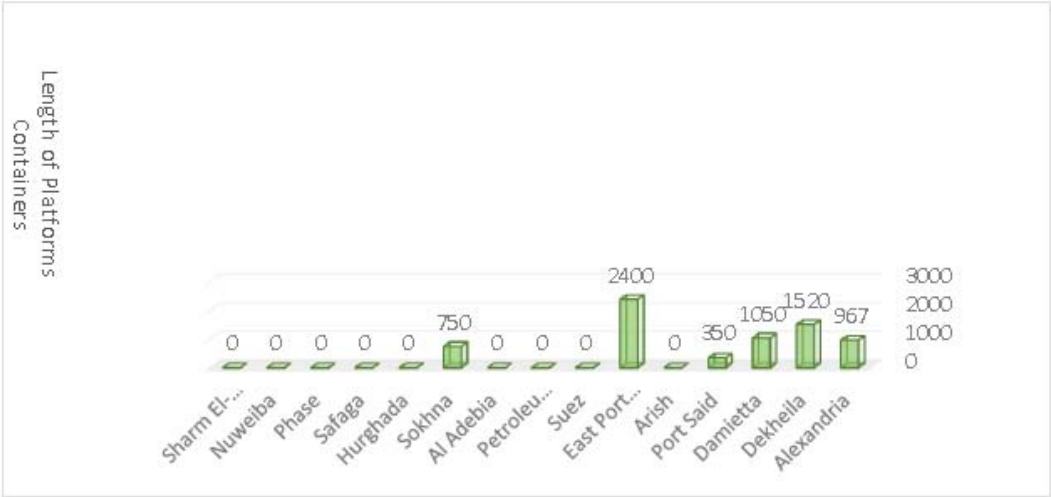

Fig. 10 Length of containers' platforms.

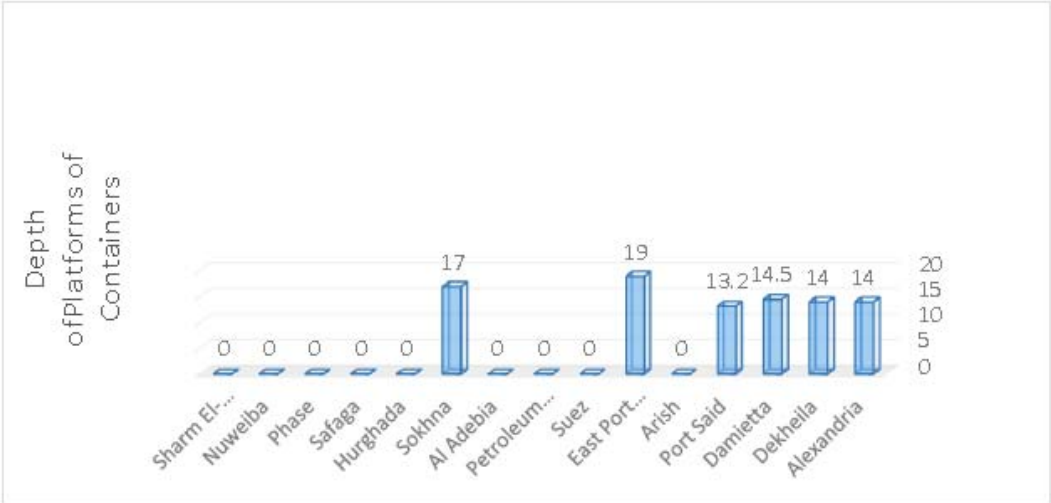

Fig. 11 Depth of quays of containers.

5.4 Relation Between Port Performance and Factors Influence

From the indicators of port performance are number of goods and number of containers. In this section, the researcher illustrates the relationship between the port's performance and the factors that may influence it, such as: total area, number of platforms of the containers, length of platforms of the containers and depth of platforms of the containers. He tests if there is a link between performance and these factors.

5.4.1 Performance and Total Area

First, the relation between port performance

(number of goods and number of containers) and total area. Fig. 12 illustrates the relationship between number of goods and total area of platforms. The graph indicates that there is a weak negative relation between number of goods and total area of platforms which means it is not optimal to increase the area of port.

Fig. 13 illustrates the relationship between number of containers and total area of platforms. The graph indicates that there is a positive relation between number of containers and total area of platforms this means increasing of the total area has a positive impact on number of containers which is an indicator for port performance.

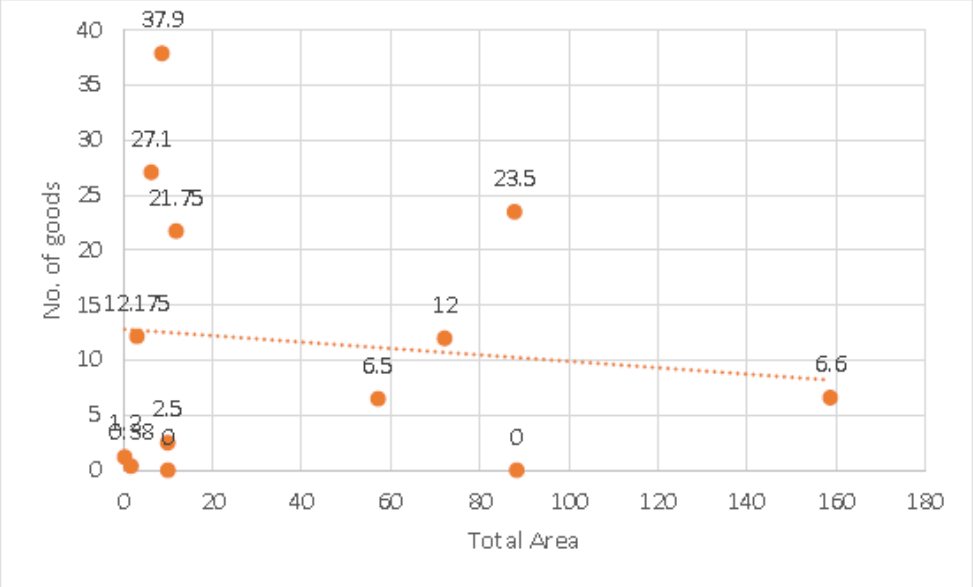

Fig. 12 No. of goods and total area.

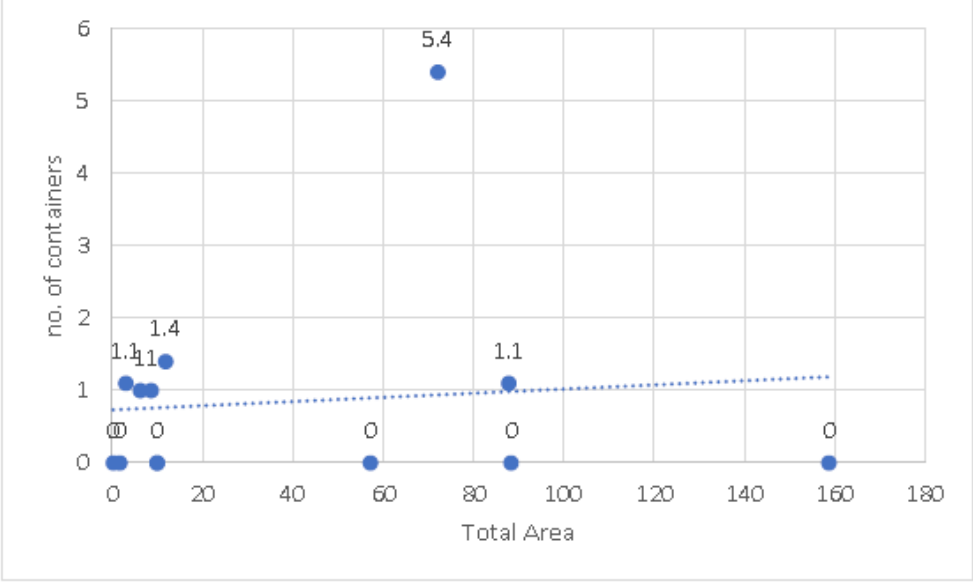

Fig. 13 Number of containers and total area.

5.4.2 Performance and Number of Platforms for Containers

Second, illustrates the relation between port performance (number of goods and number of containers) and total area. Fig. 14 illustrates the relationship between number of goods and number of

platforms for containers. The graph indicates that there is a positive relation between number of goods and number of platforms which means increasing number of platforms for containers has a positive impact on performance of ports.

Fig. 15 illustrates the relationship between number of containers and number of platforms. The graph indicates that the is a positive relation between number of containers and number of platforms for containers which means increasing the number of platforms has a positive impact on number of containers which is an indicator for port performance.

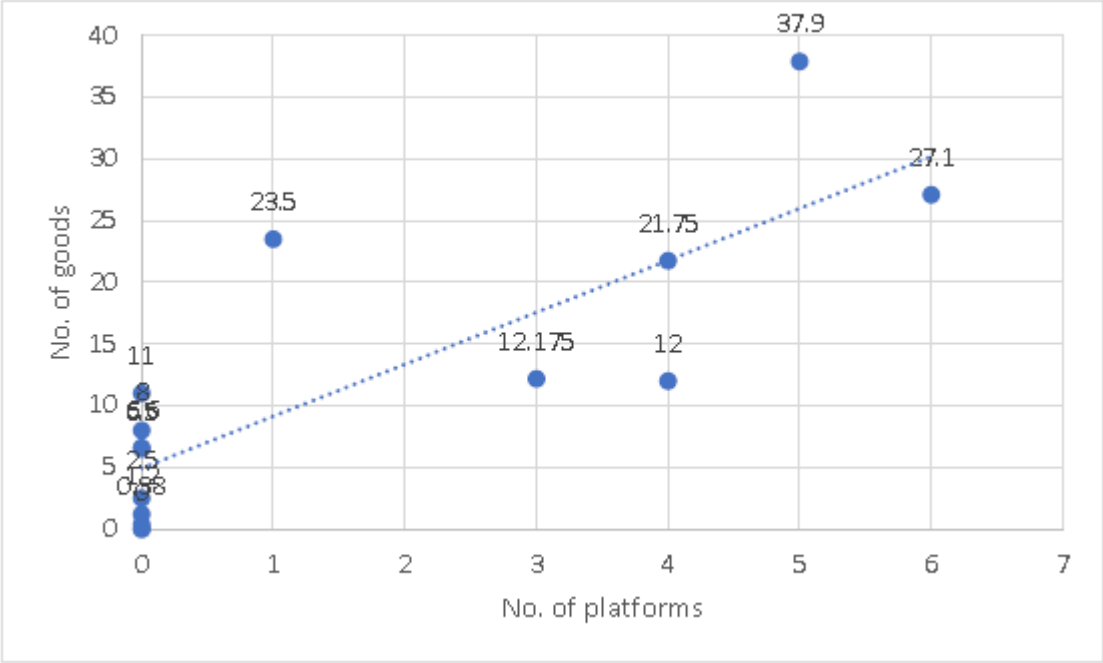

Fig. 14 Number of goods and number of platforms.

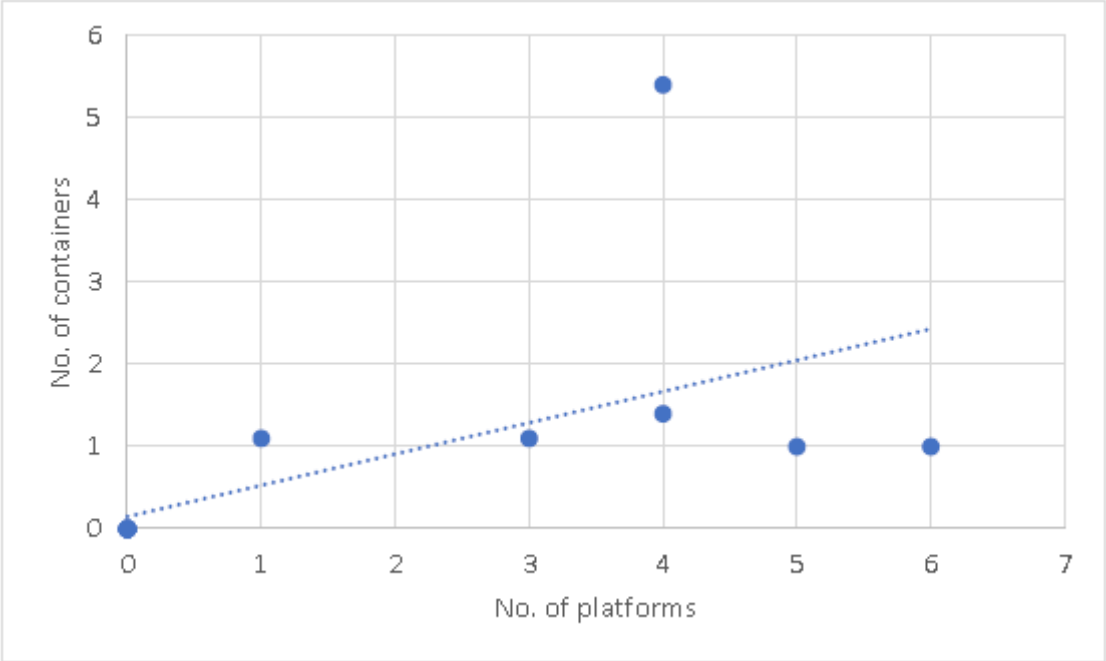

Fig. 15 Number of containers and number of platforms.

5.4.3 Performance and Length of Platform for Containers

Third, illustrates the relation between port performance (number of goods and number of containers) and total area. Fig. 16 illustrates the relationship between number of goods and length of platforms for containers. The graph indicates that there is a positive relation between number of goods and length of platforms which means increasing the length of platforms for containers has a positive impact on performance of ports.

Fig. 17 illustrates the relationship between number of containers and length of platforms. The graph indicates that there is a positive relation between number of containers and the length of platforms for the containers which means increasing the length of platforms has a positive impact on number of containers which is an indicator for port performance.

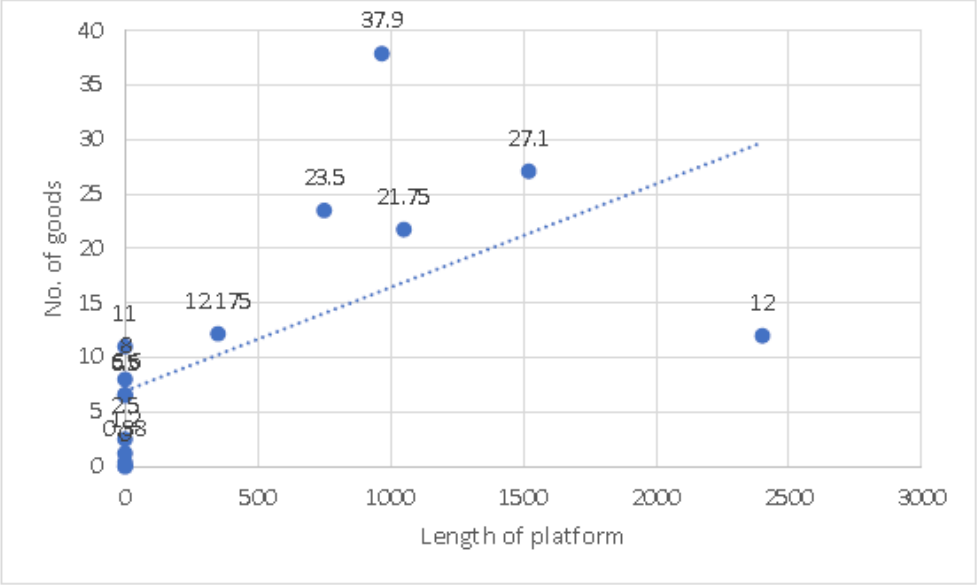

Fig. 16 Number of goods and length of platforms.

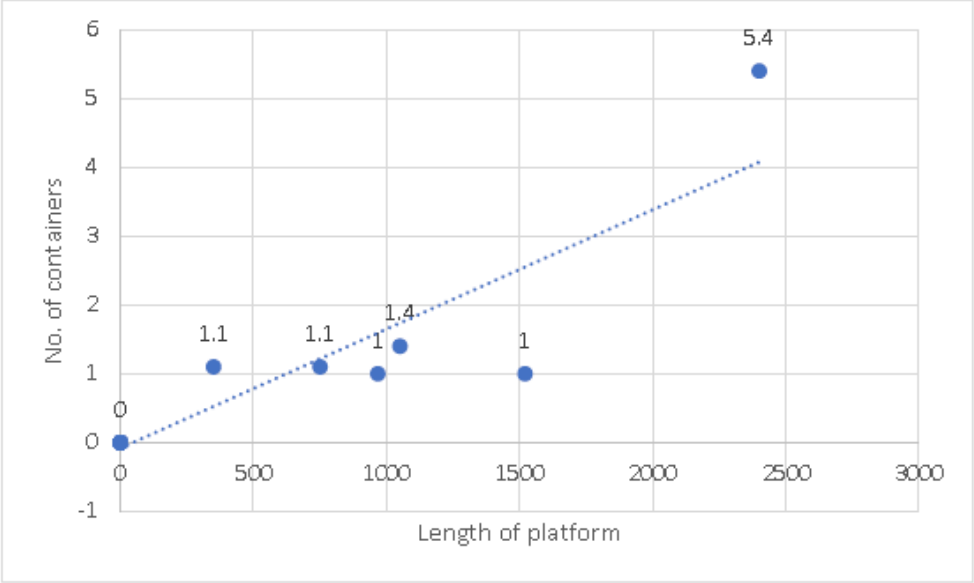

Fig. 17 Number of contents and length of platform.

5.4.4 Performance and Depth of Platform of the Containers

Fourth, illustrates the relation between port performance (number of goods and number of containers) and total area. Fig. 18 illustrates the relationship between number of goods and depth of platforms for containers. The graph indicates that there is a positive relation between number of goods and depth of platforms which means increasing the depth of platforms for containers has a positive impact on performance of ports.

Fig. 19 illustrates the relationship between number of containers and depth of platforms. The graph indicates that the is a positive relation between number of containers and the depth of platforms for the containers which means increasing the depth of platforms has a positive impact on number of containers which is an indicator for port performance.

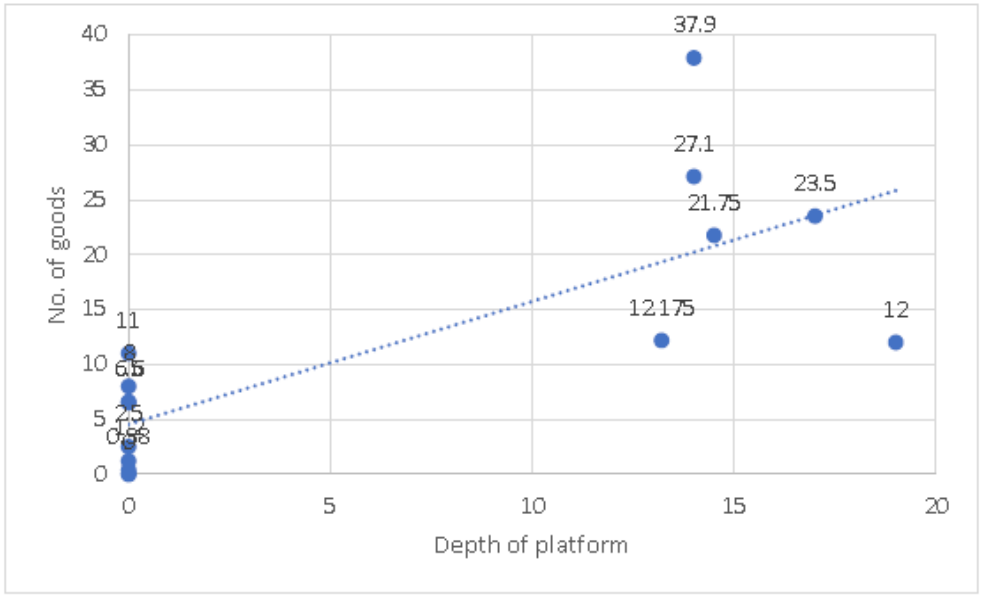

Fig. 18 Number of goods and depth of platform.

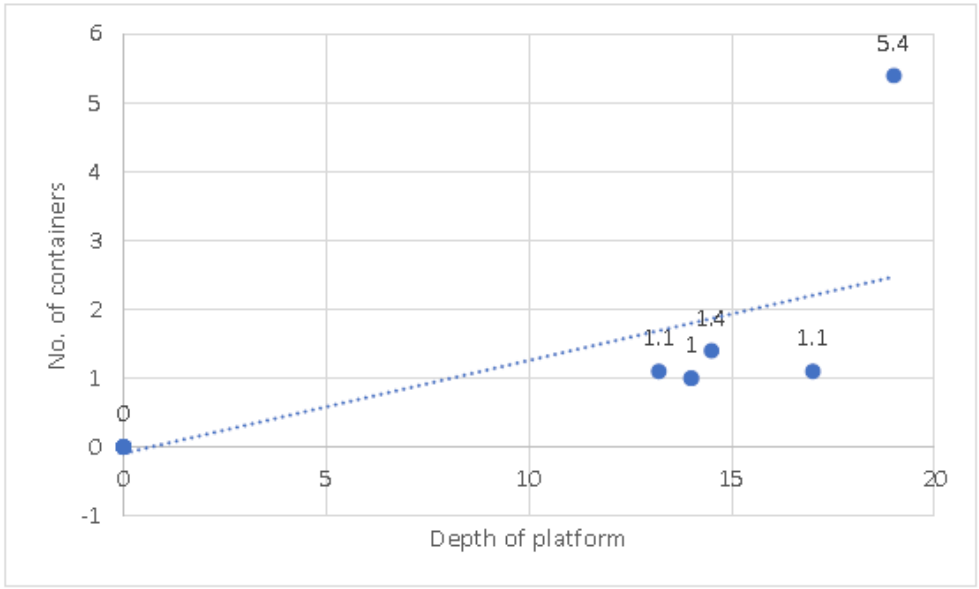

Fig. 19 Number of containers and depth of platform.

6. Conclusion

Despite the significant impact of ports on the effectiveness of international transport and trade systems, however, there is a lack of research into port operations, particularly from the perspective of port managers and service providers. Also, due to the multiplicity of ports and cargoes handled, prior studies usually restrict the scope of the analysis to a limited number of ports and a specific type of cargo. Moreover, due to the unavailability of data across ports, most studies have attempted to explain the differences in port performance by observing the performance of a port over time using time-series data. This proved that there is a significant gap in literature and supported the goal of this study in identifying a performance measurement system to evaluate and improve the Egyptian ports' performance. (The paper studies 15 Egyptian ports at one spot of time and compares between the performances of each port. Its goal is to identify the factors which affect the performance of ports.)

Studying the Egyptian ports is considered the initial stage towards raising their performance and hence their efficiency which is a part of the Egyptian government plans since 2000. Egypt is located in a sensitive place since it is located on the major trade paths between Europe and the Far East. This paper provides a comprehensive view on the Egyptian performance of the ports sector. It selected 15 of the Egyptian ports and compares between them empirically. The findings spotlight the current conditions of these ports.

Ports performance is affected by several factors, which could be claimed as average number of containers, frequency of ship calls, average port charges, and average crane hours per hours, average vessel size, and proportion of 40-foot containers. From the results of the comparison in this paper, it could be concluded that if these mentioned factors are increased, ports performance is considered as an improved factor. This has several implications, some of which could be mentioned are transport policy, port ranking among international ports and several other implications.

To sum up, performance is reflected by Total Area, Number of Platforms, Length of Platforms and Depth of Platforms. According to the above graphs, it could be observed that from the total area perspective, Port of Suez has the best performance among the other 15 ports in 2019. While Port of Alexandria is the best performance according to number of platforms perspective, length of platform perspective and depth of platform perspective.

7. Recommendations

Some recommendations are proposed for future researches. Future studies can include more variables which may affect ports' performance in their model. Also, a comparative study can be made between ports in developing countries and ports and developed countries for more reliable and comprehensive results. Moreover, this paper studied the performance of Egyptian ports in 2019, it is suggested to collect longitudinal data and study the performance through time change.

References

[1] Elzarka, S. and Elgazzar, S. 2014. "Green Port Performance Index for Sustainable Ports in Egypt: A Fuzzy AHP Approach." In: *International Forum on Shipping, Ports and Airports (IFSPA) 2014: Sustainable Development in Shipping and Transport Logistics*, Hong Kong Polytechnic University.

[2] Vieira, G. B. B., Kliemann Neto, F. J., and Amaral, F. G., 2014. "Governance, Governance Models and Port Performance: A Systematic Review." *Transport Reviews* 34 (5): 645-662.

[3] Bichou, K., and Gray, R. 2005. "A Critical Review of Conventional Terminology for Classifying Seaports." *Transportation Research Part A: Policy and Practice* 39 (1): 75-92.

[4] Lirn, T. C., Jim Wu, Y. C., and Chen, Y. J. 2013. "Green Performance Criteria for Sustainable Ports in Asia." *International Journal of Physical Distribution & Logistics Management* 43 (5/6): 427-451.

[5] Ruto, W. K., and Datche E. 2015. "Logistical Factors Influencing Port Performance a Case of Kenya Ports Authority (KPA)." *International Journal of Current Research and Review* 7 (12): 52.

[6] Kamil, I., Plamonia, M., Hasan, A., and Alias, B. 2018. "Can Supply Chain Connectivity Effect on the Relationship between Port Performance and Economic Growth?" *Int. J Sup. Chain. Mgt.* 7 (6): 462.

[7] Metalla, O., Vyshka, E., and Lumi, D. (2015). "Defining the Most Important Port Performance Indicators: A Case of Albanian Ports." *Int. J. Econ. Comm. Manag*. 3 (10): 808-819.

[8] Lim, S., Pettit, S., Abouarghoub, W., and Beresford, A. 2019. "Port Sustainability and Performance: A Systematic Literature Review." *Transportation Research Part D: Transport and Environment* 72: 47-64.

[9] Chu, L., Fwa, T. F. and Nishijima, H. 2013. "Container Port Operational Performance Assessment." *Journal of the Eastern Asia Society for Transportation Studies* 10: 2197-2209.

[10] Rezaei, J., van Wulfften Palthe, L., Tavasszy, L., Wiegmans, B., and van der Laan, F. 2019. "Port Performance Measurement in the Context of Port Choice: An MCDA Approach." *Management Decision* 57 (2) 396-417.

[11] Asariotis, R., Benamara, H., Finkenbrink, H., Hoffmann, J., Jaimurzina, A., Premti, A., Valentine, V., and Youssef, F., 2012. UNCTAD Review of Maritime Transport 2012. https://unctad.org/en/PublicationsLibrary/rmt2012_en.pdf

[12] Bergantino, A. S., Musso, E., and Porcelli, F., 2013. "Port Management Performance and Contextual Variables: Which Relationship? Methodological and Empirical Issues." *Research in Transportation Business & Management* 8: 39-49.