



THE ROLE OF APPLYING ADVANCED CARGO INFORMATION SYSTEM ON IMPROVING THE PERFORMANCE OF ALEXANDRIA PORT

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1. ABSTRACT:

Digital transformation in ports enhances efficiency, reduces congestion, and meets global trade demands through real-time data, automation, and connectivity. In this context, the implementation of the Advanced Cargo Information system (ACI) fosters better data exchange and coordination, ensuring compliance with international regulations, increasing transparency in the cargo flow, and boosting the overall efficiency and security at Alexandria port. It relies on pre-registration to identify goods, delivery dates, customs procedures, inspections, transportation, and destination. This improves planning, reduces delays, and increases transparency and credibility. ACI system enhances safety and performance, benefiting stakeholders and improving efficiency and quality in the sector. This research aims to identify the impact of applying ACI system on enhancing the performance of Alexandria port. To achieve research aim, SWOT analysis applied to identify weaknesses and threats of implementing ACI system that currently applied in Alexandria port, to understand its implementation and how to overcome the current system's drawbacks in Alexandria port. In addition, the researcher adapted a descriptive and analytical approach. An electronic questionnaire administered and analyzed using SPSS. This research has found that for the ACI system to achieve its objectives, it is necessary to emphasize the digital transformation of registering and storing data and documents. This research is considered as the first research that evaluates the customs procedures before and after applying ACI system in Alexandria port.

Keywords: Advanced Cargo Information, Customs, Digitalization, SWOT, Alexandria Port, Egypt.

2. INTRODUCTION:

Maritime ports play a crucial role in ensuring the efficient and secure flow of goods worldwide [1]. Ports offer diverse types of value-added logistical services, such as regulatory requirements related to import, export, and re-export, as well as the efficiency and safety of cargo flows. All this heavily relies on the flow of information, data, and the capabilities of modern technologies [2]; [3]. In this context, Information Technology in maritime transportation is used in two directions. The first involves ships at sea, oceans, and channels, as well as ship-to-ship communication and the management of maritime transport companies [4]. This is used for tracking vessel movements and container trading. The second direction is concerned with cargo management and optimal loading and unloading, particularly in container storage yards. While the importance of information and communication technology in ports is evident in core



activities, the introduction of a cargo registration system for imports and exports can contribute to organizing the container trading process [5]. Customs transactions with containers require information exchange between the administrative authority responsible for registering incoming shipments and the importing and exporting customers. Furthermore, there is also a link between transportation companies, the port where goods will be unloaded, and the importing party receiving the goods “was also concluded by Mahwish, [6] and Heijmann *et al.*, [7]”.

The presence of a seamless electronic system that facilitates smooth and speedy positively reflected in trade flow. It provides a greater opportunity for expansion and leveraging the advantage of enormous quantities and traded shipments [8]. Therefore, organizing the flow of information within the port community can contribute to improving institutional performance among key players, including shipping agents, the entity responsible for managing trade flow in the port, and customs authorities. This necessitates a precise and timely use of information and communication technology for inputting accurate and sufficient data. Hence, the United Nations, through the United Nations Conference on Trade and Development [18], adopted the Automated System for Customs Data (ASCD) with a standardized global code in 2013. This system simplifies customs clearance procedures by applying accounts and streamlining and expediting procedures and time. In addition, an essential component is the ACI, which involves providing access points with accurate and comprehensive information about shipments. This information was used to prepare the necessary equipment for overseeing them and completing all required procedures to facilitate handling and customs clearance [10].

Through reviewing the motivations, reasons, key developments, and discussing the reality of implementing the ACI system, there are obstacles that have faced the implementation process [9]. Therefore, it is essential to explore how the system can be used for development purposes by relying on technological tools and methods to support strategic decision-making for port management. To achieve this, it is necessary to restage and system's advantages and disadvantages, make comparisons between pre- and post-implementation stages, and analyze the various phases of implementation [16].

3. LITREATURE REVIEW:

Previous studies indicate that the field of ports faces significant challenges in the realm of information technology and digital transformation. This field focuses on the use of modern technology and transitioning to digital systems to enhance operational efficiency and competitiveness. Previous studies delve into the requirements of information technology in ports, such as upgrading technical infrastructure and implementing ACI and big data analytics to improve port management and operational efficiency. Moreover, these studies address digital transformation and its impact on supply chains, maritime transportation, and the evolution of coordination services in ports.

As for the study [11] aims to find out the goal of ports in contributing to sustainable growth by creating appropriate conditions for the adoption of new energy management models, the extent of their dependence on low environmental impact, and methods to stimulate innovation in both technologies and processes. The use of information technology in ports is vital for their advancement and economic development, exemplified by countries such as Singapore, Belgium, and the United Arab Emirates. Evidently, IT and digital technology enhance communication, decision-making, productivity, and safety in port operations. Efficient information systems and government coordination are crucial for optimal port performance; however, delays and inefficiencies can occur due to management issues and adapting to rapid changes, making port management efficiency a key indicator of IT system success [17].

As for the study of [12], it explores the importance of digital transformation, and its impact on the shipping industry. The study focuses on analyzing digital transformation in the field of ports, and its impact on the supply chains in the shipping industry. The study has revealed that digital transformation is necessary



to maintain competitiveness considering accelerated technological transformations using digital developments, as flexible and smooth services can be achieved in the port operations. Furthermore, the study has highlighted the role of digital innovation in promoting the modernization of ports, and that to understand the future challenges in this area, it is necessary to review the results of previous developments and their impact on port operations.

The study [13] also aims to identify the role of Information Technology in improving the performance of Egyptian ports from the perspective of logistics management. The most important recommendations summarized in the need for the port to use information technology in various operations within Egyptian seaports, and the application of the proposed framework that contributes to improving the performance of Egyptian seaports through information technology. On the other hand, [14] explains the relationship between the environmental requirements for the application of smart ports, and the sustainability of supply chains. Therefore, the study has investigated the relationship between the energy requirements for the application of smart ports, and the sustainability of supply chains relying on information technology in the management of its operations; through smart applications, and the transformation of the port from a traditional port to a smart port, competing with others in providing technological services to the port community. This study has recommended the need to achieve sustainability of the supply chain in all its dimensions (environmental dimension, economic dimension, social dimension). Furthermore, it has recommended information technology, communications in operations to achieve the integrated concept of smart port, attain sustainability, facilitate procedures in Egyptian ports, and fully automate them.

In Egypt, the transport sector is witnessing a revolution and major changes considering the procedures that have been followed for digital transformation, especially ACI system. By relying on solutions and compatible rules for managing incoming shipments, preventing the accumulation of goods in ports, and addressing all aspects of corruption - which have emerged over many years considering weak procedures - this ACI system contributes to enabling the state to reveal all aspects related to goods coming from abroad and determine it; where reliance on the fifth generation; to ensure that import details are disclosed securely, and within the immediate response time provided by the system. As is the case in many sectors, the AVI system will contribute to ensuring work efficiency, with the need to implement this considering a comprehensive strategy for digital transformation in a safe, appropriate, and error-free manner [9]. Moreover [15] has addressed the impact of applying smart port standards on raising the efficiency of operational performance within container terminals in seaports and increasing its competitiveness. The study is based on two main hypotheses; namely: the existence of a statistically significant relationship between the application of smart port standards, raising the efficiency of operational performance within container terminals in seaports, and showing a statistically significant relationship between the application of smart port standards within the container terminal, and increasing its competitiveness.

The study [19] has shown that the role of the Internet of Things (IoT) in supporting and advancing the transportation industry, particularly ports, has become increasingly important in recent years. Ports aim to enhance their operations and facilitate the flow of transportation within the port, making IoT technology essential. Sensors, communications, and computing devices are among the tools used to connect all elements of the port, aiding in making intelligent decisions and providing smart solutions for data collection and monitoring within the port [20]. It was mentioned that smart ports combine Internet of Things (IoT), sensor devices, decision analytics, and other technological techniques. In addition to optimizing the allocation of port resources, they connect and coordinate various functional units, transmit and exchange data across different units, and identify relationships among people, things, and ports. Moreover, [21] highlighted that advancements in information technology and communication have significantly impacted port management. Computers and wireless communication devices are now instrumental, with information systems serving as indicators of a port's efficiency and competitiveness. The adoption of modern technologies by IT departments also requires the integration of highly skilled workers, contributing to the

enhancement of the social fabric in the port's surrounding community. In this context, [22] highlights the increasing reliance on comprehensive systems that contribute to achieving digital transformation in the port sector. These systems focus on connecting all facets to enable the highest levels of flexibility, immediate adaptability to changes, and the efficient execution of operations related to foreign trade management, particularly supply chain management. These systems reduce real-time delays, costs, and the time required for port agents' responses, providing critical information about the nature, type, origin, and handling of cargo. This data enhances the overall information that management seeks to access.

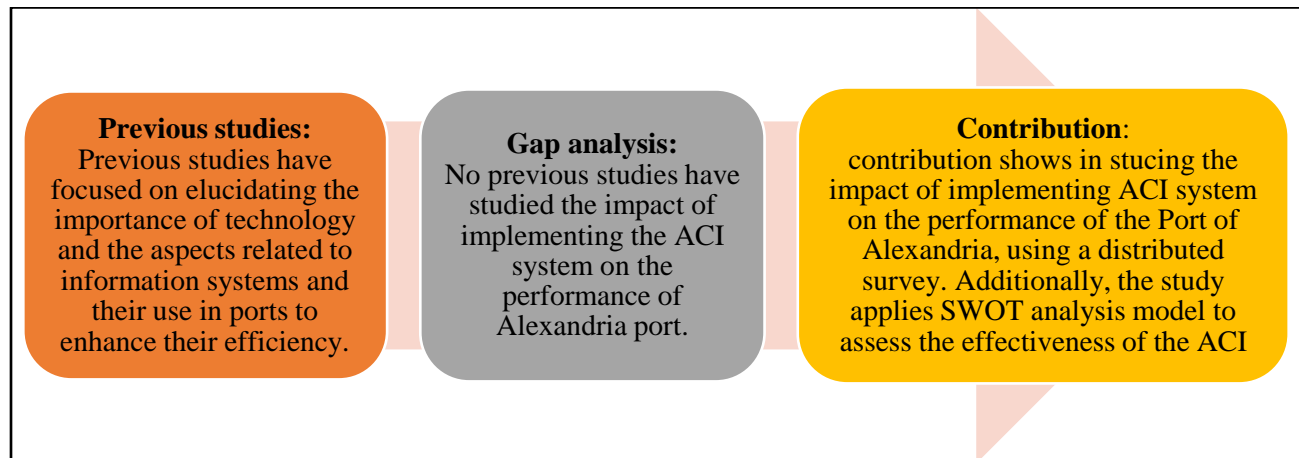


Figure 1. Gap analysis and contribution of the research.
 Reference: By researcher.

4. PROBLEM FORMULATION:

Due to procedural complexity and limited stakeholder awareness, issues have emerged during the implementation of the ACI system at Alexandria port, leading to disruptions. A significant challenge has been the incomplete adoption of the ACI system, as customs officials have continued using the old manual declaration process alongside the new system. This has had adverse effects on organizational performance. This research focuses on assessing the impact of the ACI system on the port of Alexandria's performance, including ship turnaround times, container trade volume, customer satisfaction, and financial performance. The study's problem can be summarized by the following questions:

- What are the obstacles and challenges facing the implementation of the ACI system for incoming shipments in Alexandria port?
- What is the level of impact resulting from the implementation of the ACI system on Alexandria port performance?

5. RESEARCH AIM, OBJECTIVES, AND IMPORTANCE:

This research aims to identify the impact of applying ACI on enhancing the performance of Alexandria port. This has achieved through the following sub-objectives:

- Identifying the level of difference between before and after the implementation of the ACI system at the Port of Alexandria.
- Determining the opportunities and threats facing the implementation of the system at the Port of Alexandria.

- Providing a set of recommendations and proposals considering the study's results that can enhance the constructive collaboration between the ACI system and the improvement of the Port of Alexandria's performance.

This research holds theoretical and scientific importance. The theoretical aspect involves highlighting the significance of digitization and the shift to smart ports, aiding academic discussions, and enhancing research on digital technology's impact on ports and organizational performance. The scientific aspect includes practical results obtained through surveys conducted among the port of Alexandria's employees and stakeholders, providing insights into the actual effects of implementing the ACI system and offering recommendations for improving organizational performance.

6. RESEARCH HYPOTHESES, VARIABLES AND METODOLOGY:

There are two main hypotheses. Hypothesis 1: "There is a statistically significant positive impact of the effectiveness of the ACI system on organizational performance. Sub-Hypothesis 1: "There is a statistically significant positive impact of the effectiveness of ACI system on organizational performance, represented by the number of container ships calls the port". Sub-Hypothesis 2: "There is a statistically significant positive impact of the effectiveness of ACI system on organizational performance, represented by the average ship turnaround time". Sub-Hypothesis 3: "There is a statistically significant positive impact of the effectiveness of ACI on organizational performance, represented by the total container trade volume". Sub-Hypothesis 4: "There is a statistically significant positive impact of the effectiveness of ACI system on organizational performance, represented by the cargo movement rate". Hypothesis 2: "There are no statistically significant differences in the opinions of employees and customers regarding the level of effectiveness of the implementation of the ACI system for incoming shipments".

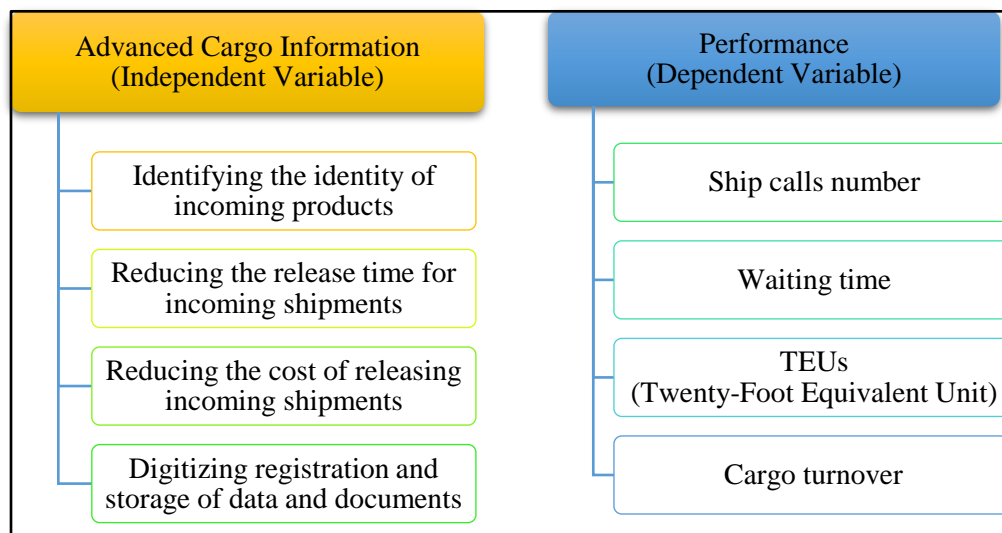


Figure 2. Research Variables.
 Reference: By researcher.

The researcher has employed a descriptive and analytical quantitative methodology as the primary approach since it aligns with the study's objectives, which involves combining descriptive and quantitative analysis. Comparative methods used to achieve the study's goals, including data presentation and analysis. The primary research method aims to analyze the documentary content of studies, books, journals, research



papers, and information from the international network. Additionally, the researcher has applied an auxiliary research method by conducting a case study to assess the impact of implementing the ACI system on the performance of Alexandria port, identifying its challenges and issues through SWOT Analysis. Furthermore, analytical statistical methods are employed using SPSS Version 26 to analyze the opinions of the study's sample, which represent the study's variables based on the study's instrument, represented by the opinion questionnaire. The study's population comprises both employees and stakeholders of the Port of Alexandria (workers and customers), estimated at 18,000 individuals, consisting of 6,000 employees and staff and 12,000 consignees and representatives of shipping agents. Given the significance of surveying the opinions of stakeholders regarding the impact of ACI system implementation on port performance, which necessitates surveying the views of port employees, a random sample is collected from department managers and section heads at the port, as well as a random sample of customers represented by customs brokers, shipping company agents, and clients. The selection of these samples is based on their proportional representation in the port's actual work. The survey was distributed to the study's sample. Sample size calculated $(18000 / (18000-1) (0.052 + 1))$ and equal to 376 samples, 450 samples collected, but insufficient samples refused and only 376 samples accepted.

7. ANALYTIC STUDY:

The ACI's has advantages as follows:

- It allows suppliers to register their shipments before their arrival, saving the time and effort required for managing paper documents at ports.
- ACI enhances public security and safety by enabling government authorities to review and analyze shipments before they arrive at the port, thus reducing the risk of suspicious or prohibited goods entering.
- Additionally, it reduces the costs associated with managing paper documents related to cargo clearance at ports.
- It facilitates the management of shipment-related data, storing it securely and systematically, thereby improving inventory management and planning efficiency.
- ACI enables direct communication between suppliers and relevant government authorities, promoting communication and collaboration among stakeholders.

In contrast, the ACI faces threats such as:

- Users face difficulty in understanding the procedures for pre-registration of shipments, which may lead to increased errors and shipping delays.
- Egypt considered one of the Arab countries suffering from complex and unclear customs procedures.
- The difficulties importers encounter when dealing with the customs authority can lead to numerous disputes and their escalation between the parties.
- The pre-registration system for shipments may result in delays in customs procedures, inspection, and clearance, causing delays in delivering goods to importers, which can affect the reputation of companies and importers.

In this context, there are weaknesses in ACI system such as; the implementation of pre-shipment codes for customs notification enhances the competitive edge of customs clearance companies, encouraging them to present competitive quotations. However, this can lead to a dispersion of merchandise owners when dealing with various companies, potentially resulting in the loss of advantageous offers from long-term partners. Previously, direct interactions between merchandise owners and customs were the norm. Still, with the current system, transactions are facilitated through the Customs Identification Number

via platforms such as "CargoX" and "Al-Nafth," subsequently raising the overall cost of goods. In this context; there are opportunities available with ACI system, such as:

- ACI can streamline the customs process, enhancing efficiency and accuracy in inspection and cargo clearance. Consequently, the system can reduce waiting times and delays in cargo processing, improving customer experiences and satisfaction.
- ACI system contributes to bolstering national security by providing up-to-date and accurate information about incoming shipments. It can also assist in improving cargo tracking, identifying potential risks, and implementing necessary measures to address them.
- ACI can help enhance operational efficiency and reduce costs associated with delayed customs clearance. By improving efficiency and reducing errors, the system can increase productivity and enhance profitability for companies dealing with customs.

To provide a set of recommendations and proposals considering the study's results that can enhance the synergy between the ACI and the improvement of Alexandria port, an electronic questionnaire has been conducted and manually distributed to employees, workers, and customs brokers at the Port of Alexandria, as well as representatives of shipping agents, with the aim of assessing the effectiveness of the ACI system. The survey questions have been formulated based on previous studies and has utilized the Likert Scale. Data analysis has been performed using the statistical analysis software SPSS-V26. Table 1 illustrates an increase in the reliability and stability of the study variables, with rates exceeding 0.7. These results indicate the quality and suitability of the data for conducting the field study and statistical analyses using this data.

Table 1. Reliability and Stability Test for Model Variables at Study Stations.

N	Variable	Reliability	Stability
1	ACI system		
	Identifying the identity of incoming products (X1)	0.73	0.85
	Reducing the release time for incoming shipments (X2)	0.82	0.91
	Reducing the cost of releasing incoming shipments (X3)	0.88	0.94
	Digitizing registration and storage of data and documents (X4)	0.74	0.86
2	Performance		
	Ship calls number (Y1)	0.77	0.88
	Waiting time (Y2)	0.89	0.94
	TEUs (Twenty-Foot Equivalent Unit) (Y3)	0.70	0.83
	Cargo turnover (Y4)	0.87	0.93
Total		0.78	0.91

Source: By researcher depending on statistical analysis.

After reviewing the basic tests to ensure the validity and reliability of the survey through the reliability and stability coefficients, as well as the construct validity test, the researcher examine the basic measures of the study's dimensions and variables by interpreting the opinions of the sample individuals regarding the items of the study's dimensions. This will be done using some statistical measures, including the mean, median, and standard deviation, as shown in Table 2. The study's dimensions are as follows:

- Regarding the dimension of identifying the imported product's identity, the opinions of the sample individuals leaned towards agreement, with an average score of 3.7340 and a total variation coefficient of 16%. This indicates a very good level of consensus among the sample individuals in favor of identifying the imported product's identity.
- As for the dimension of reducing the release time of imports, the opinions of the sample individuals also leaned towards agreement, with an average score of 3.5941 and a total variation

coefficient of 18%. This suggests a very good level of consensus among the sample individuals in favor of reducing the release time of imports.

- Regarding the dimension of reducing the cost of import release, the opinions of the sample individuals leaned towards agreement, with an average score of 3.5221 and a total variation coefficient of 17%. This indicates a very good level of consensus among the sample individuals in favor of reducing the cost of import release.
- Concerning the dimension of digital transformation for recording and storing data and documents, the opinions of the sample individuals leaned towards agreement, with an average score of 3.5191 and a total variation coefficient of 19%. This suggests a very good level of consensus among the sample individuals in favor of digital transformation for recording and storing data and documents.
- Regarding the dimension of the number of container ships calls the port, the opinions of the sample individuals leaned towards agreement, with an average score of 3.7721 and a total variation coefficient of 16%. This indicates a very good level of consensus among the sample individuals in favor of the number of container ships calls the port.
- As for the dimension of the average time ships stay, the opinions of the sample individuals leaned towards agreement, with an average score of 3.6591 and a total variation coefficient of 17%. This suggests a very good level of consensus among the sample individuals in favor of the average time ships stay.
- Regarding the dimension of the total container trade volume, the opinions of the sample individuals leaned towards agreement, with an average score of 3.7061 and a total variation coefficient of 16%. This indicates a very good level of consensus among the sample individuals in favor of the total container trade volume. Lastly, concerning the dimension of the goods' movement rate, the opinions of the sample individuals leaned towards agreement, with an average score of 3.5498 and a total variation coefficient of 18%.

Table 2. Descriptive Statistics for the Study.

Variable		Total
Identifying the identity of incoming products (X1)	Average	3.7340
	Median	3.6667
	Standard Deviation	0.6073
Reducing the release time for incoming shipments (X2)	Average	3.5495
	Median	3.6
	Standard Deviation	0.65970
Reducing the cost of releasing incoming shipments (X3)	Average	3.5770
	Median	3.5
	Standard Deviation	0.61057
Digitizing registration and storage of data and documents (X4)	Average	3.5101
	Median	3.66
	Standard Deviation	0.66891
Ship calls number (Y1)	Average	3.7721
	Median	3.75
	Standard Deviation	0.62855
Waiting time (Y2)	Average	3.6591
	Median	3.740034

Variable		Total
	Standard Deviation	0.619446
TEUs (Twenty-Foot Equivalent Unit) (Y3)	Average	3.7061
	Median	3.672
	Standard Deviation	0.672894
Cargo turnover (Y4)	Average	3.5498
	Median	3.57
	Standard Deviation	0.622781

Source: By researcher depending on statistical analysis.

These results serve as a strong indicator of the positive impact of these independent variables on the dependent variable in the three stations and at the total value level. This aligns with the study's hypotheses. Table 3 shows a sample of the population selected, consisting of 376 individuals divided into 188 customers and 188 employees. The average responses of customers and employees were calculated, and the initial results favored the employees, with an average score of 4.30. This implies that the average responses of employees were higher than those of customers. To further validate the variance between customers and employees, the total sample was calculated twice. In the second calculation, the results also favored the employees, with an average response score of 4.250 for employees compared to 3.240 for customers. This reaffirms the reliability of the survey and serves as evidence that employees have a more significant impact in this system. Employees are more influential in this system because they work on the ground and, therefore, observe the difference in handling shipping documents in this system compared to the previous manual system. This translates to cost savings in terms of floor space and container renewal expenses, as well as ensuring timely delivery of containers to customers and the return of empty containers before their renewal date. As a result, there are reduced container costs, an increase in container turnover, and a higher rate of goods movement. This system expedites the processing of shipping documents, container handling, and their timely return to shipping lines during the free time designated by the shipping lines.

Table 3. Ranking the strength of those independent variables on the dependent variable.

		N.	Average	S. D.	T. test	
The effectiveness of applying the pre-registration system for incoming shipments	Customers	93	3.504	0.704	-10.343	.000
	Staff	279	4.300	0.407		
	Customers	93	3.240	0.624	-14.828	.000
	Staff	279	4.250	0.352		

Source: By researcher depending on statistical analysis.

In studying the statistical differences between the opinions of customers and employees, an independent samples test is conducted. The results have indicated statistically significant differences between the responses of customers and employees regarding the quality of service provided and customer relationship management at a confidence level of 99%. The differences favored the employees, with the average responses being (4.30, 4.25) respectively, while the customer responses averaged (3.50, 3.24). The following findings can be concluded:

- Acceptance of the main hypothesis stating that "there is a statistically significant impact between the effectiveness of the ACI system for incoming shipments and the port's performance".
- Acceptance of the first sub-hypothesis, which states that "there is a statistically significant impact between the ACI system's effectiveness for incoming shipments and the port's performance, represented by the number of container ships calls the port."
- Acceptance of the second sub-hypothesis, which states that "there is a statistically significant impact between the effectiveness of the ACI system for incoming shipments and the port's performance, represented by the average ship turnaround time."
- Acceptance of the third sub-hypothesis, which states that "there is a statistically significant impact between the effectiveness of the ACI system for incoming shipments and the port's performance, represented by the total container trade volume."
- Acceptance of the fourth sub-hypothesis and acceptance of the alternative hypothesis, which states that "there is a statistically significant impact between the effectiveness of ACI system for incoming shipments and the port's performance, represented by cargo turnover."
- Rejection of the second main hypothesis and acceptance of the alternative hypothesis, which states that "there is a statistically significant impact between the opinions of employees and customers regarding the level of effectiveness of the implementation the ACI system for incoming shipments".

8. CONCLUSION AND RECOMMENDATIONS:

The results of the analysis have revealed the existence of positive and statistically significant relationships between the variables: identifying incoming product identity (X1), reducing the time for cargo release (X2), reducing the cost of cargo release (X3), digital transformation for recording and storing data and documents (X4), and the organizational performance of the Port of Alexandria. Furthermore, in studying the statistical differences between the opinions of customers and employees, the results have shown statistically significant differences in their responses towards the effectiveness of the ACI system at a confidence level of 99%. These differences favored the employees, with average responses of (4.30, 4.25), respectively, while customer responses averaged (3.50, 3.24). Moreover, positive Spearman correlation coefficients are found between each of the variables: identifying incoming product identity (X1), reducing the time for cargo release (X2), reducing the cost of cargo release (X3), digital transformation for recording and storing data and documents (X4), and each of the following variables: the number of container ships calls the port (Y1), average Waiting time (Y2), total container trade volume “TEUs” (Twenty-Foot Equivalent Unit) (Y3), and the Cargo turnover (Y4) at both the individual variable level and the overall sample level (meaning all combinations of the second axis variables together).

Based on the impact of implementing the (ACI; on improving the organizational performance of Alexandria port, several recommendations can be made to enhance ACI system to achieve more benefits, including providing training courses for personnel to improve the efficiency of the ACI system. Regularly updating the system to meet the changing requirements of the international shipping market. Improving planning processes to save time, effort, and resources in cargo management. Increasing transparency in cargo registration and quality and quantity control, enhancing the quality of services provided to customers by offering technical support to resolve any technical issues they may encounter. Table 4 produces a chronological proposal of recommendations. For further studies, researcher can do an analytical study of the costs of implementing ACI system and the economic assessment of its social and environmental benefits and effects.

Table 4. Chronological proposal of recommendations.

Area of development	Objectives	Duration
Alexandria Port	Training courses for employees and encouraging importers and exporters.	1 year
	Increasing transparency and improving the quality of services provided to customers.	From 1 to 5 years
	Developing an automated notification system and enhancing electronic payment services.	
	Developing information security and protection programs.	
Ministry of Transportation	Enhancing communication between port and relevant government and private entities.	From 1 to 5 years
	Enhancing the digital and technological environment of the port.	
	Enhancing cooperation with government entities and relevant organizations.	
	Developing the port's infrastructure and expanding its capacity.	
	Transitioning to a multimodal shipping system.	
Ministry of Finance	Enhancing international cooperation with global ports.	6 Month
	Establish regulations and laws governing the information center at the port, ensuring comprehensive documentation of shipments at the information center in the exporting country's port to avoid any fines for document authentication.	
	Enact legislation and laws related to the implementation of the concept of pre-registration of shipments for all types of imported goods to promote and develop local industries. Establish regulations and laws related to the strategy for developing port performance to control future changes and events.	
Ministry of Finance	Establish legislation and laws to promote and facilitate trade between exporters and importers within two years. Create laws related to the development of infrastructure to fully implement the concept of digital transformation of ports in collaboration with local and international technology companies.	From 1 to 5 years

Reference: By researcher.

9. REFERENCE:

- [1] Wan, Chengpeng, Yinxiang Zhao, Di Zhang, and Tsz Leung Yip. "Identifying important ports in maritime container shipping networks along the Maritime Silk Road." *Ocean & Coastal Management* (2021): 105738. <http://dx.doi.org/10.1016/j.ocecoaman.2021.105738>
- [2] Okorie, Chukwunke, Nicoleta Tipi, and Nick Hubbard. "Analysis of the potential contribution of value-adding services (VAS) to the competitive logistics strategy of ports." *Maritime Economics & Logistics* 18 (2016): 158-173. <http://dx.doi.org/10.1057/mel.2014.39>
- [3] Ismail, A. "Benchmarking the Efficiency of the Egyptian Container Terminals", Unpublished PhD Thesis. Arab Academy for Science Technology and Maritime Transport. (2019). <http://dx.doi.org/10.13140/RG.2.2.30134.68164>



- [4] Heilig, Leonard, and Stefan Voß. "Information systems in seaports: a categorization and overview." *Information Technology and Management* 18 (2017): 179-201. DOI: [10.1007/s10799-016-0269-1](https://doi.org/10.1007/s10799-016-0269-1)
- [5] Min, Hokey. "Developing a smart port architecture and essential elements in the era of Industry 4.0." *Maritime Economics & Logistics* 24, no. 2 (2022): 189-207. DOI: [10.1057/s41278-022-00211-3](https://doi.org/10.1057/s41278-022-00211-3)
- [6] Mahwish, A., Lawrence Henesey, and Emiliano Casalicchio. "Digitalization in container terminal logistics: A literature review." In *27th annual conference of international association of maritime economists, Athens*, pp. 1-25. 2019. <https://orcid.org/0000-0001-7486-5216>
- [7] Heijmann, Frank, Yao-Hua Tan, Boriana Rukanova, and Albert Veenstra. "The changing role of customs: Customs aligning with supply chain and information management." *World Customs Journal* 14, no. 2 (2020): 131-142.
- [8] Abdelkarim, K. A., Elmesmary, H. Ismail, A. The impact of applying Advanced Cargo Information (ACI) system for incoming shipments on improving the institutional performance of Alexandria Port. *Scientific Journal of Commercial and Environmental Studies - Suez Canal University - Arab Republic of Egypt*. (2023). DOI: <https://doi.org/10.21608/jces.2023.322928>
- [9] Al-Qassas, J. J. Economics of logistical development in Egyptian customs under the ACI pre-registration system for shipments. *Scientific Journal, Faculty of Economic Studies and Political Science*, 7(14), pp.183-220. (2022). <https://dx.doi.org/10.21608/esalexu.2022.247174>
- [10] Letterman, G. Gregory. *Basics of the international system of customs and tariffs*. BRILL, 2022. ISBN: [978-90-04-48004-9](https://doi.org/10.1017/9789004480049)
- [11] El-sakty, K. "Smart Seaports Logistics Roadmap." *Renewable Energy & Sustainable Development* 2, no. 2 (2016). <http://dx.doi.org/10.21622/resd.2016.02.2.091>
- [12] Heilig, Leonard, Silvia Schwarze, and Stefan Voß. "An analysis of digital transformation in the history and future of modern ports." (2017a). <http://dx.doi.org/10.24251/HICSS.2017.160>
- [13] Ali, S. The role of information technology in improving the performance of Egyptian seaports from the perspective of logistics management. An applied study on the new East Port Said Port. *Journal of Financial and Commercial Research*, 19 (Issue Four - Part Two), pp.175-197. (2018). <https://doi.org/10.21608/jsst.2018.62856>
- [14] Abdul Nabi, H. Al-Bir, F., Al-Shahat, N. The relationship between implementing smart port requirements and its impact on supply chain sustainability - an applied study on Port Said ports. *Journal of Environmental Sciences, Institute of Environmental Studies, and Research - Ain Shams University*. (2019). <https://doi.org/10.21608/jes.2019.68408>
- [15] El-Din, E., Abdel Qader, M., Abdel Hafez, M., Ismail, A. "Improving the efficiency of operational performance and increasing the competitiveness of sea container ports by applying smart port standards." *Scientific Journal of Commercial and Environmental Studies - Suez Canal University, second issue, April 2023 - Arab Republic of Egypt*. (2023). <https://doi.org/10.21608/jces.2023.304433>
- [16] Abdelkarim, K. A. (2023). *The Impact of applying Advanced Cargo Information on improving the Institutional performance of Seaports (Case Study: Alexandria port)*. MSc Thesis. Arab Academy for Science Technology and Maritime Transport. <http://dx.doi.org/10.13140/RG.2.2.10840.88322>
- [17] Attia, Tarek Mohammed. "Importance of communication and information technology and its applications in the development and integration of performance in seaports." *Renewable Energy and Sustainable Development* 2, no. 2 (2016): 137-146. DOI: <http://dx.doi.org/10.21622/resd.2016.02.2.137>
- [18] UNCTAD (2018) "Review of Maritime Transport", United Nations. New York. <https://doi.org/10.18356/cd4440fc-en>
- [19] Rajabi, Aboozar, Ali Khodadad Saryazdi, Abderrahmen Belfkih, and Claude Duvallat. "Towards smart port: An application of AIS data." In *2018 IEEE 20th International Conference on High Performance Computing and Communications; IEEE 16th International Conference on Smart City;*



-
- IEEE 4th International Conference on Data Science and Systems (HPCC/SmartCity/DSS)*, pp. 1414-1421. IEEE, 2018. <http://dx.doi.org/10.1109/HPCC/SmartCity/DSS.2018.00234>
- [20] Jović, Marija, Natalija Kavran, Saša Aksentijević, and Edvard Tijan. "The transition of Croatian seaports into smart ports." In *2019 42nd International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO)*, pp. 1386-1390. IEEE, 2019. <http://dx.doi.org/10.23919/MIPRO.2019.8757111>
- [21] Yau, K. A., Peng, S., Qadir, J. Low. Y. and Ling, M. H. (2020) “Towards Smart Port infrastructures: Enhancing Port Activities Using Information and Communications Technology”, *IEEE*. 8. <http://dx.doi.org/10.1109/ACCESS.2020.2990961>
- [22] Karas, Adrianna. "The role of digitalization for smart port concept." *Economic and Social Development: Book of Proceedings* (2020): 406-412.