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Towards Smart Green Blue Infrastructure

INVESTIGATING THE IMPACT OF MARITIME TRADE NEW TRENDS ON THE EGYPTIAN MARITIME PERFORMANCE

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1. ABSTRACT

Maritime transport is the pillar of global trade. The economy is generally impacted by maritime transport and its related activities. Egypt's key geographic location within major East-West trade corridors renders its maritime sector of both economic and geopolitical significance. In addition to the recent initiatives of expanding the Egyptian port capabilities the sector faces rising regional volatility risks that could hamper performance. The aim of this study is to empirically investigate the impact of maritime trade new trends including the climate change, port disruption, structural shift in globalization, external disruptions, on the Egyptian maritime transport sector performance and to what extent the digitalization practices can enhance the performance within those new trends. The methodology is focused on qualitative research using a semi-structured interview tool with the head of maritime transport sector, chairmen of ports authorities and few of the dominant companies in maritime transport. The ports that adopted digitalization were the target sample. The Findings clarified the significant impact of those trends on the maritime sector in terms of expenditures, dwell time handling rates, average waiting time, penalty fees/charges, delays, and other key performance indicators (KPIs). Finally, this study is filling the gap in the literature review, and it gives insights to the policy makers and stakeholders on the development of the maritime transport sector in Egypt. For the future work, the researchers are conducting a quantitative analysis by utilizing an online survey tool and AMOS software for structural equation model analyses (SEM).

2. INTRODUCTION

Maritime transport is the cornerstone of global trade, and an assemblage of industries depend excessively on it, where a variety of resources are transported to manufacturing hubs [1].

Approximately 80% of total trade depends on maritime transport. Following the end of World War II, the global economy grew rapidly, and this growth was closely associated with international trade that accompanied advances [2]. Maritime transport is the movement of people and products over waterways. Cargo handling, flagging, and national registry forms the maritime transport industry. Due to its integrated system, it carries offshore operations, port construction, shipbuilding, maritime services, and the transport of people and cargo [3]. It can provide a competitive advantage for any country's political, economic, and businesses situation [4].

The increasing accessibility of data related to port and shipping activities enables the maritime industry to effectively analyze and enhance its operational efficiency. Analysts are able to compare discrepancies, which aids in the modification of their actions and policies [5]. The performance indicators for maritime transport encompass various aspects, such as an assessment of port activities, specifically examining the liner shipping connectivity index, the time ships spend in ports, and operational data. So, there is a series of maritime transport performance indicators.

The World Ports Sustainability Program (WPSP) was launched in 2017 by the International Association of Ports and Harbors (IAPH) to combat both local and global issues, including climate change, mobility, digitalization, migration, and social integration. The program aims to strengthen sustainability efforts and promote international collaboration with supply chain partners, governments, and society stakeholders. It is driven by the 17 UN Sustainable Development Goals. The initiative has identified 26 indicators in the areas of finance, human resources, gender, vessel operations, cargo operations, and environment, and has created a port performance scorecard to monitor and evaluate member ports' performance using a helpful tool [6].

Assessing a country's economic success relies on its capacity to access deep-water territory and participate in maritime trade. Global capital is heavily dependent on global maritime trade and shipping [7].

Egypt is a prominent actor in world trade by virtue its position at the crossroads of Europe, Asia, and Africa, with the Nile River and the Suez Canal connecting. The transportation and storage sector, excluding the Suez Canal, makes up around 5% of the yearly GDP. The Suez Canal is a vital contributor to Egypt's foreign currency reserves and serves as the most efficient shipping route connecting Europe and Asia [8].

Nearly 90 percent of Egypt's international trade is seaborne and maritime transport services. This makes a significant contribution to its economic development. Egypt 2030 sustainable development strategy aims to develop the infrastructure as a prerequisite to improve the industrial competitiveness, and to create innovative industries. So, developing various seaports is projected to increase the ports capacity by 2030 [9]. It is unlikely that the substantial growth rates in maritime trade that are related to the globalization process and the increase in GDP per capita of developing nations will persist [10]. As presented in figure (1), maritime trade increased as a proportion of global GDP, with an increase in the maritime trade-to-GDP ratio in 2020, but during (2006 - 2014) the rate was 1.8, and this ratio decreased to less than 1 during the period between (2015 – 2021) due to new trends, changes, and disruptions.

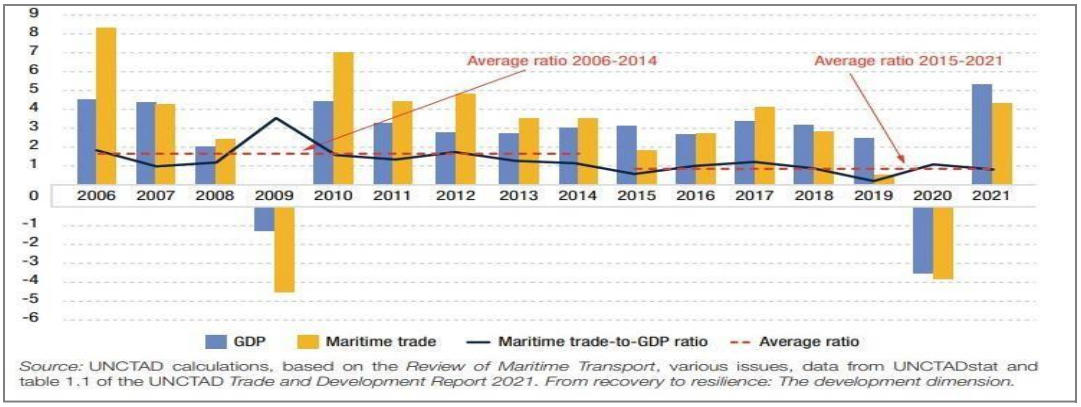

Figure 1: Maritime trade-to-GDP ratio Source: UNCTAD secrétariat

However, the implications of maritime transport on global trade, economy, and suitability of different industrial and service sectors, recently there are new trends and global disruptions that can impact the performance of this sector. These new trends reflected the moderate growth in the global economy and trade as well as increasing the uncertainty and changing the platform totally. They are the "new normal" includes the supply-side disruptions, accelerating environmental and regulatory agenda due to climate change, new technologies, innovation & digitalization, structural shifts in globalization. According to previous studies, [11 - 16] stated that there is an impact of climate change on maritime transport performance, as the studies, [17 - 20] presented the impact of structural shifts in globalization on maritime transport performance.

In 2019, COVID-19 pandemic has impacted the maritime transport sector and disrupted the shipping and maritime activity enormously [21]. Followed the pandemic, Ukraine war is one of key recent disruptions. According to Clarksons Research as published by International Union of Marine Insurance in 2022, the impacts create inefficiencies in the maritime transport. The authors [22 – 29] assess the impacts of those external disruptions and maritime transport performance. Followed those major external disruptions, the red sea disruption due to al Hotheen attacks, that severely impacted the performance in terms of transportation, shipping cost and delivery time that increased from 26 to 34 days from China to Europe [30, 35].

Digital transformation (DT) is the reformation of business models as a result of and through the adoption of digital technologies in order to create setting within the organization and the surrounded areas where new digital capabilities can be realized, and value is created [36].

The reports of UNCTAD in 2019 mentioned that shipping and port businesses faced a challenge of ensuring technology uptake and transfer to avoid the reduction in maritime sector capabilities and of increasing financing and investment with a view to develop the infrastructure and services [37]. Moreover, the players in the shipping industry are altering their business and partnership models by utilizing digitization and the new technologies collaborative platforms and solutions, such as blockchain. Through the increased visibility in supply chain and the use of electronic documents, these seek to promote efficient and secure trade, which will ultimately benefit customers who depend on the services provided by the shipping industry. Recent studies [38, 39] investigated the role of digitalization to limit the severe impact of external disruptions and other new trends on the sector performance.

3. RESEARCH PROBLEM

Despite the significance of maritime transport to trade, there were new trends and changes that increased the uncertainty and dropped the growth in international maritime trade in 2019 to its lowest level since the global financial crisis of 2008 – 2009. As in early 2020, the abnormal global health and economic crisis triggered many changes that darkened the short-term prospects of

maritime transport and trade. Reviewing previous studies with regard to the new trends and disruptions and their impacts on the sector performance, the researcher identified the "Maritime transport new trends" includes Climate Change, Port disruptions, structural shifts in globalization and external disruptions. It was found that the majority of previous studies were built on international reports and reviews and there are limited studies that combine all the key new trends in the context of developing countries [40, 37], as presented in figure (2).

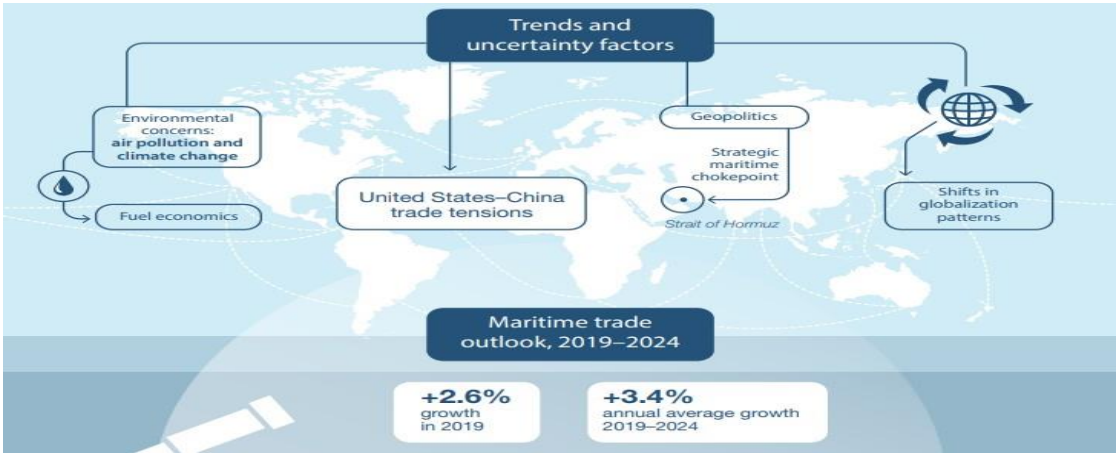

Figure 2: Maritime Trade Outlook, 2019 - 2024 Source: UNCTAD secretariat

Moreover, the stakeholders of maritime transport are increasingly taking advantage of digitalization, new technologies and innovations with their promoted joint collaborative platforms and solutions that change the business models to limit the impact of disruptions. However, the majority of the previous studies assess the medication role of digitalization on the maritime transport performance in developing and developed counties. Therefore, the problem of the research can be summarized on the following questions:

- What are the new trends that impact on maritime transport performance?
- How can those new trends impact on the Egyptian maritime transport performance?
- To what extent the digitalization enhances the maritime performance within those new trends?

4. RESEARCH OBJECTIVES

The study aims to empirically investigate the impact of the key new trends (climate change, port disruption, structural shift in globalization, external disruption) on the Egyptian maritime transport performance with the adoption of the digitalization practices. So, the objectives of this study are:

- To investigate the new trends that impact the Egyptian maritime transport performance.
- To describe the impact of those new trends on the Egyptian maritime transport sector in terms of key performance indicators with the implementation of digitization practices in Egyptian maritime sector.
- To propose recommendations for the stakeholders of maritime transport sector to minimize the impact of those new trends and enhance the digitization practices in Egyptian maritime sector.

5. LITERATURE REVIEW

In this study, the approach in reviewing literature is extended to include published literature such as books, conference proceedings, and literature obtained from electronic sources. In addition to the search engines for literature such as Google Scholar, Science Direct, and Springer Link databases. Keywords were used to find related literature such as "climate change", "port disruption", "structural shift in globalization", external disruption, "covid 19", "Russian Ukrainian war", "digitalization", "maritime transport", "maritime trade", "Egyptian maritime transport sector". The publications were found in the areas of maritime trade, maritime performance, and Egyptian maritime transport sector. To have additional sources of information, the cited references in each relevant literature were detected and examined. Consequently, a number of academic publications were used to conduct a review of previous studies during the period from 2006 to 2023. The following section presents the new trends and the related studies that summarized from reviewing the literature.

5.1. Climate change

Environmental sustainability has grown to be a key policy issue in global maritime transport in recent years. Regulations motivated by environmental concerns are changing the dynamics of the shipping market. In 2018, there is an increased concern toward the issues related to fuel economy and others related to environmental sustainability, and this trend persisted in 2019 and after [37]. Climate as defined by the United Nations Framework Convention on Climate Change (UNFCC) is a variation in climate that modifies the composition of the global atmosphere and is added to natural climate variability seen over a comparable period of time and that is applied by the attributed activities of humans either directly or indirectly [41]. The changes include sea level rise, increase of the intensity and frequency of storms and winds, increase of temperature, changes in the intensity and frequency of extreme precipitation events, floods, and droughts. Potentially vulnerable to these changes include transport infrastructure and operation, while the repercussions can be permanent, e.g. loss of infrastructure, or temporary, e.g. disruption of services [42].

Climate change causes alterations in the occurrence, strength, geographical range, length, and timing of extreme weather events, which may lead to unprecedented levels of extremity [43]. Observations of numerous instances of extreme weather events have indicated alterations since the middle of the 20th century. Climate change is altering the worldwide socio-economic framework and will persist in doing so. This is expected to have a significant effect on the advancement towards the Sustainable Development Goals, disrupt international trade, and intensify social conflicts, inequities, and human security concerns. To prevent surpassing critical thresholds of the climate system, it is imperative to achieve changes and substantial reductions in emissions [44].

Meanwhile, the perspectives of experts in ports, supply chains, and natural hazards promoted that climate change has significant threats to global security and trade that will have key challenges for ports and supply chains over the next century [45]. Furthermore, the author [46] identified the systemic risks to global maritime transport, trade, and supply-chain networks by combining estimated climatic-related port downtime at 1,320 ports with a global model of transport flows. The result was a total of US$81 billion of global trade and US$122 billion of economic activity will be at risk annually.

5.2. Port Disruption

With the growing uncertainty and rapid changes, disruptions are inevitable. Supply chains are exposed to many different types of disruptions that can affect markets and businesses [47]. These disruptions can start at a certain point in a supply chain and spread [48]. Global shipping, global maritime transport, trade, and supply-chain networks can be systemically impacted by the disruptions to ports from climate extremes. Those risks were identified by using a global model of transport flows to combine the predicted climatic- related port downtime at 1,320 ports [46].

Port disruption and a port shutdown impacted the maritime supply chains, agents and the different stakeholders affected directly or indirectly by a port disruption. So, the authors reviewed the current agents on the maritime supply chain then examined economic impacts concurrent with a port disruption [49].

Ports have varied functions and their impacts on supply chains are different. To develop a concept for a general port disruption in the supply chain system is an intriguing problem. As, the entire supply chain system can be collapsed by a significant disruption. So, the port's ability to continue operations can be impacted by any disruptions at a port then impacted the supply chains and the parties served by the port [50]. Seaports are platforms within the global supply chains and production networks. These chains are highly dynamic in reacting with global trade patterns, consumer preferences, and advances in supply chain management and information technology. As ports act as a link that supports the interaction between global supply chains with the regional production and consumption markets. Global supply chains became complex, pressuring the logistics industry to simultaneously improve their costs, performance, and resilience to disruptions [51].

5.3. Structural shift in globalization

''Globalization'' is one of the earliest and most prevalent issues in international business (IB) studies. The concept refers to the expansion and widening of international economic exchange relationships of one country with others in the world, as indicated by trade and foreign direct investment (FDI) flows, as well as other forms of exchanges like capital, people, technology, ideas, and efficient institutional practices [52, 53]. An essential component of successful development is structural change. The patterns of structural change varied among regions and countries during the period 1985 - 2015 due to globalization and variation in resources [54].

Similarly, the deeper changes in the nature of globalization have gone largely unnoticed, as the global financial crisis and recession obscured some of the shifts [55]. As, globalization reached a turning point in the mid-2000s, and the challenges are getting steeper for countries that missed out on the last wave of globalization. As the mix of countries, companies, and workers that stand to gain in the next era is changing, so understanding how the landscape is shifting will help policy makers and business leaders prepare for globalization's opportunities and challenges.

The authors in reference [20] concluded that there are ongoing developments, and challenges with other changes related to globalization that affect the control over safety levels in maritime transport. Globalization promotes new challenges and opportunities that are adapted by the industry's participants and regulatory bodies. One of the main forces behind globalization is maritime transport, and the international ships that operate outside the national regulations. Furthermore, as a result of the mega-trends of globalization, markets, labor and products mobility, and regulation, the framework conditions of entities accountable for safety in the transport sectors are changing.

In reference [17], globalization presents novel difficulties and offers growth prospects for robust and dynamic enterprises, as well as emerging industries that influence global markets and the economy. The study provided an analysis of the magnitude of shifts in the global economy on a worldwide scale and demonstrated the interconnectedness between economic globalization and the advancement of marine shipping. In order to achieve this objective, two approaches were identified in the deliberations. The first point highlights the significance of globalization in the advancement of maritime transportation, while the second point emphasizes the contribution of developing intermodal technologies to the expansion of globalization processes in the global economy. Such a separation emerges from the nature of these events and their reciprocal linkage, as the interconnectedness that takes place in the global economy is clear.

Globalization is a longstanding occurrence [56], with the aim to improve standard of living, health, and economics for humanity. However, the consequences were unforeseen, affecting society, the

environment, and climate. Therefore, globalization has resulted in significant repercussions and transformations that need to be acknowledged. The effects and difficulties of globalization require comprehensive worldwide recognition in order to make informed decisions regarding necessary global activities.

5.4. External disruptions

The unanticipated shocks have affected variables related to various aspects of human life and their interaction, and that necessitate specific and adjusted analysis [57]. Disruption risks sourcing from natural disasters, political instability, terrorist attack, microeconomics uncertainties, social uncertainties, diseases, and epidemics / pandemics constitute the seventh type of risk categorize as the environmental side risks [58].

The reference [59] highlighted some of the global crises that have arose and continue to escalate due to the increasing implications of COVID-19 and the ongoing Russia-Ukraine conflict, with a focus on how the funding of climate change can help achieve equitable and impartial transition mechanisms and how peace could accelerate and maintain this effort.

The COVID-19 pandemic had an impact on the global economy. According to Clarkson's research, the development of the epidemic dropped the volume of global maritime trade in 2020 by 3.8% to 115 billion tons. But the freight market situation has improved in the middle of 2020 due to the increase of China's demand and the high distribution of transport capacity. The cost control of the supply chain in response to crisis was the problem of international logistics enterprises. Since, there is more attention to the control after the event but neglects the cost prediction, flexible cost analysis and the opportunity of competition [60].

The study [61] identified the prospected global economic consequences of Covid-19 under several scenarios in order to guide policymakers to the advantages of international integrated policies designed to face the virus. As keeping on the challenge for policymakers to develop an adequate macroeconomic policy response because of the uncertainty of the disease's progression and potential economic consequences.

Since 2020, the global health crisis known as COVID-19 has caused considerable disruption to the global economy, especially in the maritime sector. Due to health and safety regulations, the operators experienced operational losses, and the seafarers or passengers were rigorously quarantined. These constraints impacted the freight rates, charter prices, earnings, revenues, and the usage of facilities and human resources. Further, the cruise industry has suffered enormous losses due to the limited cabin areas.

While successful turnaround opportunities and a reduction in the expected operating risk following the COVID-19 could be achieved by the efficient port state inspections based on IMO regulations and big data applications [62].

In the geopolitical analysis of the Russian Ukraine war, the war represents the first major war in Europe after World War II. The war is not yet over, and the world is witnessing the unfolding of a horrible geopolitical drama. The war is an escalation of an old conflict between the geopolitical ambitions of NATO and Russia. Sooner or later the war will be over, but the impact would have serious repercussions for the world and may cause significant disruption to the global economy [63].

The war in Ukraine has created an additional burden on the maritime industry. The war has disrupted global shipping, and triggered the ongoing supply chain disruption, port congestion and crew crises caused by the Covid-19 pandemic. The loss of life and ships in the Black Sea, the disruption of trade with Russia and Ukraine, sanctions, daily operations, effects for crew, bunker fuel availability and cost, and the possibility of cyber risk are all difficulties facing the maritime industry [64].

The study [65] asserted that the conflict in Ukraine constitutes a humanitarian catastrophe for the country, while also having far-reaching economic repercussions on a worldwide scale. This immediate analysis examines the direct influence of the conflict on global trade and investment. This analysis analyzes the specific trade and investment channels that will be impacted by the war in different countries. According to the analysis, global trade is projected to decrease by 1 percent, resulting in a decrease of 0.7 percent in global GDP and a decrease of 1 percent in the GDP of low-income nations. The war's lasting consequences for global trade and investment will mostly hinge on the actions taken by nations in response to the evolving geopolitical landscape.

Clarkson anticipated that it would take a considerable amount of time for the effects of the Ukraine conflict and the Covid-19 interruption to subside, resulting in congestion. Additionally, it is anticipated that the Ukraine crisis would result in both direct and indirect consequences that will lead to additional inefficiencies within the maritime transport sector [66].

5.5. *Digitalization*

In recent years, almost all industries have started investigating new digital technologies. This usually entails changing the key business operations and has an impact on processes, goods, services, the organizational structures, and management concepts [67].

As technology refers to the adoption and application of modern digital innovations and technologies, along with their safety and compatibility, the maritime industry is rapidly undergoing technological transformation due to the increasing utilization of digital systems, smart sensors, and networks to transfer data among stakeholders [68]. Digitalization is the incorporation of digital technology into daily life via the transformation of everything that can be digitized [69].

The reports of UNCTAD in 2019 states that one of the challenges facing the shipping and port industries is to ensure that technology is adopted and transferred to prevent a decrease in the capabilities of the maritime sector and to increase financing and investment in order to develop and upgrade infrastructure and services. Moreover, enterprises in the shipping sector are modifying their business and partnership structures as a result of progressively utilizing digitalization and cooperative platforms and solutions enabled by new technologies and innovations. Customers who depend on the services provided by the shipping sector are expected to benefit from these initiatives that encourage efficient and secure trade by providing more supply chain visibility and the adoption of electronic records [37].

Furthermore, the study [68] examined the elements that facilitate and hinder digitization in maritime transport. Since the development of Block-chain, autonomous shipping and other innovative technologies definitely foster digital transformation in the maritime sector. However, compared to other industries, there are obstacles that hamper the transition, such as a lack of awareness, insufficient standards, and a lack of cooperation among stakeholders. But the findings are served in shaping the strategies for successful transformation. In reference [70], the effects of digitization on the maritime industry have been studied from social, legal, and technical perspectives. for that, digitalization in the shipping industry should be viewed as a shift in the way business is delivered through the use of cutting-edge technologies.

The study [71] concluded that the digitalization of ports constitutes a fundamental shift in the maritime industry, giving several benefits, as ports will adapt to the new challenges of increasing productivity and efficiency. Port customers are searching for new technical solutions, as ports are more vulnerable to cyberattacks while implementing new technology, such blockchain for supply chain management, IoT sensors, and autonomous vessels, as well as to improve productivity, automation, visibility and transparency, flexibility and adaptation, and environmental sustainability.

6. RESEARCH METHODOLOGY

Regarding all the previous aspects and according to the research objectives, the purpose of this research is mixed descriptive and exploratory research. It is describing the new trends that on the maritime transport performance and to extent those trends impact the sector totally and partially in terms of specific indicators through reviewing the literature.

Then, the researcher conducted qualitative research using a semi-structured interview tool with industry experts and leaders in the sector. The researcher scope is Egyptian maritime transport sector. The main questions of the interviews about the maritime trade new trends and their impacts on the Egyptian maritime transport sector performance in terms of actions and key performance indicators. The ports that have adopted digitalization were the target sample. Five interviews were conducted with the head of maritime transport sector, chairmen of ports authorities and some of the leading companies working in the field of maritime transport.

7. RESULTS AND DISCUSSION

The researcher conducted five semi-structured face-to-face interviews with five experts and officials of the Egyptian maritime transport sector to perform an in-depth investigation and identification of the impact of Maritime trade new trends (Climate Change, Port disruptions, Structural shifts in globalization and External disruptions) and Egyptian Maritime Transport Sector Performance moderated by Digitalization.

The analysis of the interview manuscripts involves examining the responses to open-ended interview questions. The respondents freely expressed their ideas, some of which related to their understanding of quality in their previous experiences of industry-based learning.

The interviewees answered questions in a controlled setting. The majority of interviewees stated the following in each section of interview as follows:

7.1. Climate Change

(1) Climate Change and rising sea levels represent a great challenge to many countries in the world, especially on the coastal areas of deltas with sea water.

(2) There is a process of monitoring climate changes depending on the periodical measures of the sea level and the Bathymetry that study the underwater depth.

(3) There are historical and archive information including the water levels, waves, winds, and temperatures, and that show changes over time, so they follow up the Climatological station affiliated with the Coastal Protection Authority and monitor the meteorology.

(4) The impact of climate related events varies between low and moderate, as several ports closed and sometimes the port traffic stops due to weather conditions and the related disruption.

(5) The extent of impact of climate changes is very low in terms of increase of expenditures for equipment and labor, ships dwell time, number of tugboats needed for ships maneuvers, disruption in logistic services, damage of the navigational aids, physical damage, and delays.

(6) As the impact is very low in terms of decrease of productivity and revenues. Although the extent of impact may be high in terms of the decrease in the handling rate but the impact on the handling volume is limited, so the impact on the port is limited and the period does not exceed 15 days, including closing hours during the year.

(7) The government helps in the adaptation to climate change through Egypt National Climate Change

Strategy (NCCS) 2050 that developed at the request of the National Council for Climate to compile all data on climate change into a single document that can serve as a guide to guarantee that it is considered when making general plans across all sectors.

(8) Some ports carried out some actions as adaptation measures to climate change as, signing agreements with the international entities to study the effect of climate change on Egyptian ports and set actions to reduce the effects. Other ports increase the construction of breakwaters and others increase the length of the existing ones to protect the ports.

7.2. Globalization

(1) Globalization enabled the free exchange of goods and services that helped the port / company immensely and in many cases increase the handling rates.

(2) Change of rules (i.e., regulation and laws) impacted the market in which the port / company operates and affects performance. As the unexpected changes of rules required specific measures and a specific time to allow the change and provisions to be disseminated in the port community, and to obligate operating companies to the provisions of these rules.

(3) Globalization is the outcome of trade liberalization, as the integration among countries resulted in:

- Increasing the cooperation agreements and encourages trade with foreign partners.
- Enhancing the optimal performance of the port / company through the frequent and effective exchange of information that allows decision makers to take frequent and effective actions.
- Increasing the quality of services and reducing the time of procedures by the National Single Window for Foreign Trade platform (NAFEZA), built by Misr Technology Systems (MTS).
- Providing incentives, reducing the prices to offer competitive prices, and reducing the time in the port as considered to be main factors for the port's service quality.

(4) The impact of globalization extended to:

- Increase of container handling volume in majority of ports and expected to increase 3 times in 2025 in some ports, and the increase of revenues of new investments and projects.
- Provide incentives and quality of services through the competition related to globalization.
- Allow the free movement of human and financial resources that includes the working of public and private sector together for effective operation.
- Adopting advanced technology that enhances work processes and procedures to provide electronic services, speedy automated procedures, and real business value services.

7.3. Disruption

(1) There are risk management departments concerned with the operational risks and security that determine the disruption, threats, categorize them, and set different scenarios to deal with the internal and external risks and disruption.

(2) In dealing with the internal and external disruption, all of parties:

- follow the International Ship and Port Facility Security (ISPS) Code amendment which offers an extensive set of guidelines for enhancing the security of ships and port facilities.

- Assign experts to periodical supervision necessary for specific aspects of the projects. In addition to the internal risk management in accordance with the international standards in areas of environment, quality, safety, and occupational health.

(3) The internal disruption impacts the performance in terms of:

- Increase of price of fuel result in increasing the equipment's expenditures, ships dwell time and delays, and the disruption in logistic services related to reduction of labor.

- Decrease in handling rate, productivity, and revenues as the number of vessels changed.

- Overall physical damage and interruptions, but no effect on reputation, or services quality.

- Moderate effects on expenditures for equipment and labor in some ports.

(4) There are some challenges in mitigating internal risk and disruptions as:

- Lack of methodology for tax and customs exemptions for project components.

- Global political and economic changes that affect global trade and port activities.

- Modern technology in operation and logistical services, which became mandatory.

(5) They successfully managed supply chain disruptions in terms of:

- Working during crises and developing the automation index and paper transactions.

- Electronic payments for services facilitate the workflow.

- Activating the key performance indicator systems for each organizational division and for the ports with details to measure performance and determine the extent of success.

- Analyzing data related to handling rates (Loading and unloading rates), average waiting time, penalty fees/charges, time to release goods at the port.

(6) Either regional or international war are external disruptions that have a notable impact on the Egyptian ports.

(7) The world faces a severe disruption because of Covid and Russian Ukraine war, as:

- Covid and Russian Ukraine war resulted in a substantial decrease in passenger transport in 2020, then in 2022, in addition to the subsequent geopolitical changes in the movement of goods around the world, especially bulk goods.

- Covid 19 global port restrictions and quarantine requirements lead to complex operational planning. Delays in the scheduled arrival of vessels had negative effects waste on devices, equipment, and yards reserved for handling, as well as transportation and storage, resulted in long waiting period in the port until the berths and handling equipment are arranged.

- The global implementation of COVID-19 travels restrictions resulted in a long waiting time for vessels at major ports around the globe. This has caused a backlog of shipments and containers waiting to be delivered to the distribution centers that resulted in creating congestion and limiting the capacity of shipping companies.

- Companies stated that Covid and Russian Ukraine war have considerable impact on the supply chain disruptions specially from the logistics side including the supply and shipping delays.

- The majority of ports stated that during covid the total revenue of the port and transport sector declines and the price of port services increases with the increase of global prices.

- The global restrictions, ports were most affected by the decrease in ship traffic, passenger traffic, and volumes of cargo. As, a fewer number of workers being able to handle shipments.

- Keeping ports operating during lockdown increases the cost for companies. Given the increased risk related to health and safety, operations and working practices had been adjusted.

- Private sector companies operating in the port also had to implement aspects and adopt new concepts to support their business continuity plans (including new sanitary protocols and processes). These changes reduced productivity levels until the revised procedures and protocols became normalized.

(8) Of the positive effects in facing the disruption of the pandemic and the Russian-Ukrainian war:

- Adopting modern technology to speed up the completion of logistical operations, in addition to developing smart systems and programs to manage and implement tasks and services at all organizational divisions, with the conversion to automation and paperless transactions.

- Applying standards to achieve the transition to a green port.

- Some ports review the plans to cope with covid impact and succeeded in achieving the highest handling rate in the port's history as Alexandria Port Authority (APA).

- Egypt ports also impacted by the massive explosion in Beirut's port and Aqaba port accident, as the ports has started disposing of abandoned and dangerous materials from its ports, and that considered to be a positive impact of external disruptions.

7.4. Digitalization

(1) The port / company has digitalized business processes. Since current technology makes it possible to update to more advanced digital technologies. The ports have electronic systems for most of the processes from the ship arrival, loading, releasing the goods and the exit from the outlets. The effectiveness of communication helps in work implementation and accreditation of just-in-time system (JIT).

(2) The port community dealt electronically, and they are linked to the integration system to exchange data, as the results are delivered to clients such as shipping agencies, cargo agents, and other stakeholders. As, all maritime forms converted into electronic forms in Egypt ports.

(3) Egypt ports activate the national platform Misr Technology Services "MTS" in commercial transactions that is a trade & transport logistics platform, provider in compliance with international standards and best practices. The target platforms provide electronic services, speedy automated procedures, and real business value services in a unified manner.

(4) The Government, through its Egyptian Customs Authorities, has made mandatory Advance Cargo Information (ACI) declarations with its new Customs law #207 for all cargo in 2021.

(5) Using NAFEZA, and CargoX as the blockchain document transfer gateway service provider.

(6) They allow the employees to participate in adapting digital technologies through periodical meetings

between the port authority and the working companies to listen to their ideas concerning the upgrading of working system and trying to implement it as possible.

(7) The majority of ports have training centers that were established under the affiliation of the General Administration for Training in the port with a highly qualified and experienced team according to international standards. The centers aim at qualifying human cadres to keep pace with technological development, to meet the requirements of the labor market.

(8) There are cooperation protocols with specialists as the Arab Academy for Science and Technology, and Alexandria University Faculty of Engineering, Commerce, and Law.

(9) They regularly invest in cutting-edge technology to develop their business and services digitally in all processes and procedures to reduce paperwork and facilitate procedures.

In addition to the interview survey, the researchers are conducting quantitative analysis by using a survey questionnaire tool. The sample of the study is chosen based on the Convenient Sampling approach and targeting (700) participants from the Egyptian maritime transport sector authorities, employees, entities, and stakeholders. Then, the structural equation model analyses (SEM) will be employed by using AMOS 25 software to validate the theoretical model by examining the causal relationships between (Climate Change, Port disruptions, Structural shifts in globalization and External disruptions) and the Egyptian Maritime Transport sector performance moderated by Digitalization.

8. CONCLUSION, RECOMMENDATIONS, LIMITATIONS AND FUTURE RESEARCH

The contribution of this study is to empirically investigate the impact of key new trends and changes (climate change, port disruption, structural shift in globalization, external disruption) on the maritime transport sector performance with moderation role of digitalization, and how Egypt adapts with the new changes and trends. Based on results and previous studies, the researchers recommend the following actions:

(1) Perform a comparative assessment of adaptation strategies and capacities across different Egyptian ports to identify best practices and opportunities to strengthen adaptive governance.

(2) Monitor key economic, social, and environmental indicators related to maritime supply chains over an extended time horizon to detect impacts and support ongoing risk assessment.

(3) Evaluate policy options to enhance supply chain resilience through tools like emergency response coordination, infrastructure upgrades, fuel efficiency standards, and workforce training. A national adaptation strategy could help integrate such actions.

(4) Partner with international organizations to leverage technical and financial resources that support port modernization, and regional cooperation on issues like piracy and rescue.

(5) Investigate how global shifts toward protectionism and reshoring impact Egypt's role in global shipping and logistics networks.

(6) Analyze the vulnerabilities and gaps in Egypt's maritime cybersecurity and provide guidance for enhancing resilience to external disruptions like piracy, terrorism, and cyber-attacks.

(7) Conduct cost-benefit analyses to weigh adaptation strategies, such as fleet or port infrastructure improvements, for the Egyptian maritime sector to adjust to emerging trends.

(8) Compare Egypt's maritime development policies and performance indicators to regional and global

benchmarks to identify areas for strategic development.

The main limitation of this study, the research scope was the Egyptian maritime sector with limited number of interviewees, conclusions drawn may have limited applicability to other nations with different economic, geographic, and institutional contexts. However, lessons could still inform comparative future research. Also, there are another trends and disruptions that affect the Egyptian maritime transport sector, such as geopolitics and political instability, terrorism, and piracy, that can be assessed.

Researchers can continue integrating insights from Egyptian maritime professionals throughout inquiry processes to conduct future research in the following areas: investigating the disruptions that affect the Egyptian maritime transport sector, such as political instability, and piracy, and assess their impact on the sector's performance. Besides, Evaluating the impact of technology and innovation on the Egyptian maritime transport sector, including the adoption of autonomous ships, blockchain, and other digital technologies.

9. RESEARCH IMPLICATIONS

This study's contribution is to empirically investigate the impact of key new trends and changes (climate change, port disruption, structural shift in globalization, external disruption) on the maritime transport sector performance with moderation role of digitalization, and how Egypt adapts with the new changes and trends. The study fills the gap of knowledge due to the limited studies precisely in developing countries that combine all those trends in one study and their impact in the existence of digitalization as a moderator variable. Also, the study highlights the role digitalization in decreasing the impact of those changes on maritime transport performance as to operate effectively and efficiently.

This study provides practical contribution through the proposed recommendations and learning lessons related to the impact of key new trends as independent variables on Egyptian maritime transport Sector performance that presented to help Egyptian maritime transport sector authorities and stakeholders to adjust and to adapt to the new operating landscape, in addition to achieve goals and to enhance performance. The study also identifies the best practices and lessons learned from other countries that have implemented and can be strategies or initiatives to cope with and adapt in Egypt.

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