Title

Towards an Integrated Egyptian Maritime Transport Sector: Horizontal and Vertical Integration of Egyptian Commercial Ports

Short Title or Acronym

Integrated-MTS

Keywords

Container Terminals, Port Congestion, Port Demand Management (PDM), Port Integration.

Thematic Focus

Collaborative Research Project (CRP): Engineering (all disciplines including marine and offshore engineering)

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Proposal Summary: English and Arabic (max. one page each)

Ports are recognized as crucial nodes in global transport and logistics chains. Port congestion, that occurs when port demand exceeds the capacity it offers, is one important phenomenon that prevents ports from fitting into their logistics chains. In addition to the time loss and high cost imposed on shipping companies, congestion is also problematic for other port actors.

Over the years, decision-makers believed that spending more on port infra- and super-structure is the prescription for battling port congestion and the recipe for improving economic growth. While useful, port capital infra- and super-structure investments and annual maintenance costs are substantial and may not reap their intended benefits. As such, the determination of the extent of integration of ports/terminals among themselves (i.e. horizontal integration) and within the global supply chains (i.e. vertical integration) have become of great importance.

This Collaborative Research Project (CRP) suggests a paradigm shift from the traditional supply-driven port investments to a more holistic port planning approach called "*Port Demand Management (PDM)*". PDM is the application of strategies and policies to alleviate port congestion by influencing customers' port/container terminal choice behaviour (demand) without altering the capacity of the system (supply).

To realize PDM, this research adopts the following twofold approach: First, understand what factors affect customers' port/terminal choice behaviour. Second, provide customers with incentives (disincentives) to attract (repel) them to (from) a certain port/terminal.

The expected result of this project is a strategic plan for the Egyptian maritime transport sector utilizing the concepts of horizontal and vertical integration under the envisioned context of PDM. Special attention will be given to the national container companies operating under the supervision of the Holding Company for Maritime and Land Transport (HCMLT), affiliated to the Egyptian government. The findings will then be scaled to tackle the congestion problem at the port-level.

In general, the benefits of the proposed PDM cannot be overstated as it is expected to help reduce port/container terminal congestion (without the need to pump huge infra- and super-structure investments) by directing the state of the system from a user equilibrium, that captures port/terminal customers' selfish choice behaviour, towards a more efficient system optimum.

This project is right up the research alley of MRCC Team given their expertise that spans across transportation engineering and planning, ports and terminal operation, shipping lines work, IT applications in the maritime sector, analytical research in the maritime sector, strategic analysis, quantitative and qualitative research methods, feasibility studies, corporate social responsibility, and performance evaluation.

ملخص المقترح باللغة العربية (بحد أقصى صفحة واحدة)

تعتبر الموانئ نقاط أساسية في سلاسل الإمداد والخدمات اللوجستية العالمية. يعد التكدس، الذي يحدث عادة عندما يتجاوز الطلب على الخدمات التي تقدمها الموانئ طاقاتها الاستيعابية، إحدى الظواهر التي تحد الموانئ من أداء دورها بشكل جيد في سلاسل اللوجستيات. بالإضافة إلى اهدار الوقت والتكلفة العالية التي يفرضها التكدس على شركات الشحن والخطوط الملاحية، يمثل التكدس مشكلة لجهات اخري فاعلة داخل مجتمع الميناء.

يتجه مُتخذي القرار إلى زيادة الإنفاق على البنية التحتية والفوقية للموانئ لمواجهة ظاهرة التكدس والتغلب عليها وبالتالي تحسين معدلات النمو الاقتصادي، إلا أن هذا التوجه لا يعد حلا لهذه المشكلة. قد يكون الاستثمار في البنية التحتية والفوقية مفيدا في بعض الحالات، إلا أن تكاليف الصيانة السنوية تكون مرتفعة جداً وفي كثير من الحالات لا تجني الفوائد المرجوة من تلك الاستثمارات. ومن هذا المنطلق، يأتي مفهوم التكامل بنوعيه بين الموانئ أو محطات الحاويات فيما بينها (التكامل الأفقي) وكذلك التكامل داخل سلاسل الإمداد واللوجستيات العالمية (التكامل الرأسي) للتغلب على مشكلة التكدس بالميناء دون ضخ المزيد من الاستثمارات في البنية التحتية والفوقية.

يقدم هذا المقترح البحثي نقلة نوعية في التغلب على ظاهرة التكدس في الموانئ ومحطات الحاويات من خلال تقديم نهج تخطيط أكثر شمولية مبني على ادارة الطلب. فبدلاً من الاستثمارات التقليدية في البنية التحتية والفوقية لاستيعاب الزيادة في الطلب، يقدم هذا المقترح البحثي مفهوم "إدارة الطلب على الموانئ" عبر تطبيق مجموعة من الإستراتيجيات والسياسات التي تؤثر على اختيار العملاء للميناء أو محطة الحاويات (الطلب) دون الحاجة لزيادة طاقتها الاستيعابية (العرض).

ولتحقيق مفهوم إدارة الطلب على الموانئ، يتخذ هذا البحث النهج التالي: أولاً، تحديد ودراسة العوامل التي تؤثر على اختيار العملاء للميناء/محطة الحاويات. ثانياً، تقديم الحوافز (المثبطات) لجذب (لإبعاد) العملاء إلى (عن) محطة معينة أو توجيههم إلى محطة أخرى.

يقدم هذا المشروع البحثي خطة استراتيجية لقطاع النقل البحري المصري باستخدام مفاهيم التكامل الأفقي والرأسي في ضوء نظام "إدارة الطلب على الموانئ". يُولى البحث اهتمام خاص بشركات الحاويات الوطنية العاملة تحت مظلة الشركة القابضة للنقل البحري والبري التابعة للحكومة المصرية. ومن ثم، سيتم توسيع نطاق نتائج البحث لمعالجة مشكلة التكدس على مستوى الميناء ككل.

بشكل عام، يساهم النظام المقترح لإدارة الطلب على الموانئ في تقليل التكدس في الموانئ ومحطات الحاويات دون الحاجة إلى ضخ استثمارات ضخمة في البنية التحتية والفوقية، وذلك من خلال توجيه نظام العمل بالموانئ من حالة تعكس السلوكيات المنفردة لكل ميناء على حدة وفقاً لمصالحها الفردية إلى الحالة المثلى التي تحقق المنفعة لنظام الموانئ (وقطاع النقل البحري) ككل.

يقع هذا المشروع مباشرة في نطاق الخبرات البحثية لفريق مركز البحوث والاستشارات لقطاع النقل البحري نظراً لخبراتهم في مجالات متعددة مثل هندسة وتخطيط النقل، تشغيل الموانئ ومحطات الحاويات، البحوث التحليلية للخطوط الملاحية، تطبيقات تكنولوجيا المعلومات في القطاع البحري، البحوث التحليلية في القطاع البحري، التحليل الإستراتيجي، طرق البحث الكمي والنوعي، دراسات الجدوى، المسؤولية الاجتماعية للشركات، وتقييم الأداء.

Introduction/Background (max. three pages)

Ports are widely recognized as crucial nodes in global transport and logistics chains. Traditionally, the importance of ports stemmed from the fact that their core activities (i.e. receiving vessels, loading/unloading/storing cargo, and transferring cargo from/to land transport) are key to international trade representing a relatively large share in the total supply chain cost. Nowadays, ports are not merely considered as transfer points between sea and land, but also they are looked at as logistical platforms that may ultimately offer port-to-door services. Accordingly, port activities are increasingly required to fit perfectly in the logistics chains of which seaports are an integral part of.

In practice, this is by far not always the case. One important phenomenon that prevents ports from fitting into their logistics chains is "*congestion*". In general, congestion occurs when port demand (i.e. cargo volume) exceeds offered capacity (i.e. port infra- and super-structure). Congestion may also occur due to restricted access to seaports, routine procedures, poor connectivity with hinterland and shipping lines, inconsistent government policies, and inability of some ports to deal with new technological trends [1, 2].

When a port is said to be congested, it commonly means that ships are queuing, waiting to obtain a berth, at a high detrimental impact on the overall system throughput and generalized cost. Commonly, congestion affects terminals, hinterland connection points, and hinterland transport. In addition to the time loss and high cost imposed on shipping companies, congestion is also problematic for other port actors. Vessels whose arrival at berth is delayed due to congestion may be difficult to fit into the loading and unloading schedules of the terminal operator. The same holds for other actors such as storage and hinterland transportation. Moreover, a ripple effect may be felt elsewhere in the maritime transport chain (i.e. delays in one port may impact operations in other ports of call). Therefore, acquiring adequate insights into how port congestion arises, and how it can be alleviated or avoided is important [2].

Over the years, decision-makers believed that spending more on port infrastructure (e.g. internal locks, docks, quays, jetty piers, berths, and harbour basin dredging) and superstructure (e.g. warehouses, sheds, cranes/gantries, and other mobile/semi-mobile equipment) is the prescription for battling port congestion and the recipe for improving economic growth. Unfortunately, these claims are highly disputable [3-5].

Port infra- and super-structure are critical to nations' economy and has seen major expansion over the last few decades. Conventionally, and following the "*If you build it, they will come.*" motto, the main role of port authorities worldwide has been the provision of infra- and super-structure to increase capacity and improve intra-port operations. Further, in the future there are likely to be further demands for port capacity which will require additional port areas [6]. Nevertheless, this approach to port planning is neither economically nor environmentally sustainable. Moreover,

becoming a scarce resource, competition for land among different uses is becoming acute. Therefore, some ports might not find space for growth (e.g. Alexandria Port).

While useful, port capital infrastructure investments and annual maintenance costs are substantial and may; for various reasons, not reap their intended benefits, especially when capacity (i.e. supply) does not meet demand. Besides being extremely expensive, this approach, rather than providing a cure, tend to only mask the issue by moving congestion in space (e.g. increasing quay and/or yard capacity to accommodate the increasing freight volume may create a bottleneck at the port/terminal gates) and time (e.g. at times of slowdown in economic growth, excess port capacity and idleness of port assets could become a serious problem).

With overcapacity and wasted resources becoming increasingly severe, creating synergy (e.g. sharing assets/resources) among ports and with their supply chains have become important issues in the fields of port operation and management.

In recent times, the role of ports has changed from infrastructure providers to being members of the supply chain (i.e. a port is now considered a component of a cluster of organisations where different logistics and transport operators are involved to deliver value to the final customers). As such, the determination of the extent of integration of ports/terminals among themselves, also known as horizontal integration (i.e. acquisition of entities that perform a similar function either as a process of consolidation or for market penetration) and within the global supply chains, also known as vertical integration (i.e. provision of a wide array of services connecting the foreland and the hinterland) have become of great importance [2, 7].

On the one hand, introducing horizontal integration as a business management strategy can aid in keeping up with the dynamic changes of the container market and the service competition [8]. Horizontal integration may serve as a solution over resorting to investing unnecessarily in infra- and super-structure, thus; creating benefits of lowering the cost and increasing economies of scale, as well as reducing the duplication of resources within the integrated ports. Furthermore, it may lead to an increase in market share or even contribute in adding new market segments which consequently increases the ports' competitiveness [9].

On the other hand, vertical integration between terminal operators and shipping lines, for example, can be an important source of synergy for the maritime industry that leads to higher port capacity, market output, and consumer surplus. It can also reduce delay costs. Although vertical integration increases the participating carrier's output at the expenses of non-integrating rival shipping firms, research has shown that vertically integrated ports handle more cargo volumes and are associated with better infrastructure and equipment utilization [10].

In light of the above, this project suggests a paradigm shift from the traditional supply-driven port investments to a more holistic port planning approach called "***Port Demand Management (PDM)***".

PDM in a nutshell, and as envisioned by this project, is the application of actions or policies to alleviate port congestion by influencing customers' (e.g. shipping lines, shipping alliances, consignees, and/or cargo owners) port/container terminal choice behaviour (demand) without altering the capacity of the system (supply). For PDM to be attained, a bunch of measures and transport planning policies should be utilized under the following threefold approach to sustainable transportation/port planning:

- Offering customers one or more alternative port/container terminal options of excess capacity/underutilized assets;
- Providing incentives/disincentives to redirect customers to the offered options and/or reschedule services to off-peak hours in attempt to reduce demand on congested ports/container terminals; and/or
- Reliance on Information Technology (IT) to reduce human involvement in operations through automation and/or ensure the rapid and accurate transfer of the enormous amounts of data processed in ports/terminals [11].

PDM actions or policies can be implemented in many ways. For example, policies can be inter- or intra-port, or can target clusters of ports or specific commodity types. For PDM to be successful, strong authority, think-tank for implementation, strong leadership, and political will are required.

This research will contribute to knowledge from different perspectives. First, it will provide a better understanding of the relationship between carriers/shippers (i.e. demand) and ports/container terminals (i.e. supply), where knowledge is still fragmented. Second, and unlike previous studies, this research will evaluate the effectiveness of both horizontal and vertical integration (separately and combined) in handling ports/container terminals congestion problems from a strategic viewpoint using the new concept of PDM. Third, and from a contextual perspective, this study is the first to address the above issues in the Egyptian context, where severe competition exists among national container companies and with the private terminals operating in Egypt, East Mediterranean, and the Red Sea.

Questions and Objectives (Max. three pages)

Egypt is located in the North East of Africa. It is bordered by the Mediterranean Sea to the North and the Red Sea to the East. Egypt has 15 commercial ports; of which, six overlook the Mediterranean and nine overlook the Red Sea. Egypt also has the most significant navigation channel in the world (The Suez Canal) that facilitates the transit of global trade. The Mediterranean region is characterized by high levels of competition between its container terminals to obtain a greater share of seaborne trade volume in the region. Despite the blend that Egyptian ports enjoy, none of the Egyptian ports/container terminals is among the Top 50 World Container Ports since 2011. In recent years, other competing ports in the Mediterranean region were among that list, like Port of Piraeus (Greece) and Port of Marsaxlokk (Malta).

The Holding Company for Maritime and Land Transport (HCMLT), affiliated to the government has three container and cargo handling companies operating through four container terminals in the following Egyptian ports overlooking the Mediterranean: Alexandria, El-Dekheila, Damietta, and West Port Said Ports. The three companies (and the ports they operate at) face many challenges that affect their performance and financial results.

The goal of this project is to study the reasons for the low performance of the three national companies and how they could maintain advanced positions among their competitors in the Mediterranean, and among the Top 50 World Container Ports.

To attain this goal, two wider objectives will be achieved. First, assess the performance of the three Egyptian container and cargo handling companies and benchmark them among their rivals in the Eastern Mediterranean region. Second, identify practically-sound Port Demand Management (PDM) measures and transportation/port planning policies to support the three Egyptian companies, individually and combined under HCMLT, to maximize their market shares and potential as main foreign trade and transhipment players in the region in light of the rapid developments and severe competition in the maritime transport sector. As opposed to the traditional supply-driven approach to port planning, PDM aims at the first place at alleviating port congestion by influencing customers' (e.g. shipping lines, shipping alliances, consignees, and/or cargo owners) port/container terminal choice behaviour (i.e. demand) without investing in additional system capacity (i.e. supply).

The specific objectives of this project are as follows:

1) Conduct a literature review on the concepts of horizontal and vertical integration, their various types and forms, the main factors and conditions affecting port integration, and successful applications of these concepts worldwide.
2) Analyze the performance of Alexandria, Port Said, and Damietta Container and Cargo Handling Companies over a reasonable timeframe.
3) Conduct capacity calculations for the container terminals of the three companies including their infrastructure (berths, yards, etc.), superstructure (cranes, reach stackers, etc.), and analyze points of strengths and weaknesses of the companies' ability to utilize their capacity.
4) Analyze the network of shipping lines calling Egyptian ports and the development of the handling volumes (shares) of these lines with the three Egyptian companies over the timeframe of the study.
5) Investigate the effect of planned container terminals (i.e. new projects) in Egyptian ports and the developments in competing container terminals/ports in the Eastern Mediterranean on the market shares of the three Egyptian container and cargo handling companies.
6) Identify alternative Port Demand Management (PDM) policies to support the three Egyptian companies, individually and combined, to maximize their market shares and potential in the region and solve congestion problems without the cost of new infrastructure investments.

The challenge facing this project is the balance between the cost of horizontal/vertical integration (e.g. advantages granted to shipping lines, cost of inland transportation of goods, etc.) and the desired benefits from such integration (e.g. retain existing shipping lines and attract new ones to Egyptian ports, use idle resources, increase revenues, etc.).

Upon completion, this project will offer a strategic plan for the Egyptian maritime transport sector utilizing the concepts of horizontal and vertical integration under the envisioned context of Port Demand Management (PDM). Although special attention will be given to the national container and cargo handling companies, the practical applications (i.e. policies and strategies) of this research will be scaled to tackle the congestion problem at the port-level.

Potential success of this project and of Port Demand Management (PDM) as a concept stems from the fact that demand management; in general, has proven to be an effective way to reduce urban congestion worldwide [12-15].

Project Description (max. six pages)

Egypt is a maritime country that has a wide network of commercial, specialized, mining, fishing, and touristic ports located on its over 2,000 km coastlines along the Mediterranean Sea, Red Sea, and the Suez Canal. Egyptian seaports are not an exception to the recent changes in the role of port authorities (transforming from infrastructure providers to being members of the supply chain) [16]. To adapt to local and global variables and compete regionally/globally, the development of the Egyptian Maritime Transport Sector has become a top priority. This project intends to explore the possibility of achieving horizontal and vertical integration among Egyptian ports and supply chains to enhance their competitiveness with neighbouring rivals.

In more specific terms, this project tries to offer solutions to the congestion problem in suffering Egyptian seaports (with emphasis on the three national container companies), under the umbrella of Port Demand Management (PDM), without the need to pump huge infra- and super-structure investments.

A strong indicator of congestion, especially at container terminals, is the terminal capacity utilization. High levels of capacity utilization (i.e. 70% or more) may reflect severe congestion which results in a decline in the level-of-service provided by the port, warns against ship traffic awaiting the quay, leads to an increase in service time and cost, and eventually increases demurrage penalties. On the contrary, low levels of capacity utilization indicate the existence of idle resources that are not used properly which results in a decline in revenues [17, 18].

The following table shows the values of capacity utilization in Egyptian seaports. As indicated, Alexandria Port suffers from severe congestion, whereas other Egyptian ports experience lack of proper utilization of resources and facilities and presence of idle capacity. Source: Maritime Research and Consultation Center (MRCC) 2020.

Table 1.1 Container terminals capacity utilization (2020)

Port	Capacity Utilization (%)
Alexandria	88
El-Dekheila	45
Damietta	56
West Port Said	35

With overcapacity and wasted resources becoming increasingly severe, the integration of Egyptian seaports has become an important issue in the fields of port operation and management. Creating synergies between Egyptian seaports using innovative solutions may solve the problem without the need for adding capacity. In more precise terms, utilizing the excess capacity at El-Dekheila, Damietta, and Port Said Ports to fill the gap between demand and capacity in Alexandria Port [19-21].

Project Approach: Towards a Port Demand Management (PDM) System

The goal of this project is to develop a national Port Demand Management (PDM) system under consideration of existing and planned capacity and infrastructure which serves the national market and enhances international trade (including also transit- and transhipment trade). The proposed PDM system should enable relevant ports to maintain and/or strengthen its position in key markets and to maximize the benefits associated with its geographical location and competitive advantages.

As a general principle and guideline, it is important for the proposed PDM system to establish a competitive port environment which allows free choice for shipping lines and shippers for container transports as far as possible. Dry- and liquid bulk markets rely on government-owned specially adapted facilities, as such they are differently organised with a large degree of vertical integration.

Seaports and their closely linked logistics sector, the industrial clusters, and the maritime industry have a significant economic importance for Egypt. High efforts of the public sector and the private sector are required to maintain the operation and expansion of maritime transport infrastructure. To ensure public investment requirements into maritime infrastructure and into land infrastructure access, cooperation, coopetition, and integration schemes between seaports seem to be a possible solution to take advantage of potential synergy effects.

Step 1: Creating synergy between ports

The first step in the proposed PDM system is to offer customers one or more alternative port/container terminal options of excess capacity/underutilized assets through the creation of synergy between ports. Ways of synergy creation differ; not only between involved port authorities and/or terminal operators, but also between trade corridors, port functions, and port locations. (a) A Memorandum of Understanding (MoU) is one basic form of synergy creation between two or more port authorities on a single trade lane (e.g. Shanghai-Hamburg and Rotterdam-New

York). Ports in close geographical distance are faced with the choice to (b) Compete in a cooperative manner, referred to as “Coopetition”; or they might even decide to (c) Integrate by agreeing on a joint-venture company [22-24].

a) ***Memorandum of Understanding (MoU)***, where port authorities (farther apart and possibly from different countries) cooperate with each other with the main intention to facilitate and intensify trade links to increase port throughput. Regular delegation visits of political/private representatives are a way to foster these trade relationships. Such strategic statements refer to facilitating import, export, and transhipment of goods, fast customs clearance, sharing hinterland information, joint marketing actions, environment/security issues, and personnel training.

b) ***Coopetition of ports in proximity***: The concept of coopetition attained popularity in game theory and was picked up in strategic management by Nalebuff, Brandenburger [25], who suggested that managers overcome traditional competitive thinking by cooperating with competitors to create value. In coopetition the ports focus on their individual strengths and weaknesses and segment their service offerings to attract new customers [26]. A big opportunity is to generate competitive advantage against other rival ports. Common ways of action are cooperative marketing and sourcing, sharing of personnel and equipment, and investment in terminal facilities.

c) ***Port integration***: A more stringent term for the closest form of synergy creation is integration. Port integration takes place between publicly state or municipality owned port authorities operating in a commercially oriented manner and complying with normal commercial law and one or several private terminal operators by foundation of a joint-venture company. This is supported by Song [27] who highlights a joint-venture of terminal operators as a main strategy for the ports of Hong Kong and Yantian. Integrated tasks span from cargo handling and storage to traffic management, marketing, and strategic port planning. Possible benefits for partners are increased port handling efficiency and international competitiveness, and bearing the risk of infra- and super-structure investments [26].

In the local Egyptian context, the need to study the feasibility of integration between the three state-owned containers companies or to continue the competition has become necessary, especially in light of the new challenges brought by shipping lines and the market as a whole. The decision to compete, cooperate, or to even specialize in handling certain commodity type(s) depends on many factors and conditions such as the political rules, ports regulation, and economic conditions, etc., and these factors must be taken into consideration when choosing between these two alternatives. This decision also depends on the benefit derived from each alternative; as the continuation of competition may achieve benefits that exceed those achieved by integration, such as increasing the throughput, enhancing productivity, and/or achieving customer satisfaction.

Step 2: (dis)incentivize customers to redirect/reschedule demand
The second step in the proposed PDM system is to provide incentives/disincentives to redirect customers to the offered options and reschedule services to off-peak hours in attempt to reduce demand on congestion ports/container terminals.

Ports and terminals can create incentive/disincentive programmes to influence their customers (e.g. shipping lines, cargo owners, etc.) to choose a certain port and/or terminal. The Port of Los Angeles introduced an incentive programme in 2014 by giving a refund for each container (TEU) above the previous year volumes for each carrier. If the container volumes increased by more than 100,000 TEU the refund rate was further increased. Port of Long Beach has introduced a similar incentive programme and another example is QTerminals in Qatar who has introduced incentives to the main shipping lines that have direct services calling Hamad Port and do not tranship within a range of 250 nautical miles.

Step 3: utilization of IT to reduce inefficiencies in port business processes
The third step in the proposed PDM system is to rely on Information Technology (IT) to reduce human involvement in operations through automation and/or ensure the rapid and accurate transfer and processing of the enormous amounts of data processed in ports/container terminals.

A Port Community System (PCS), an electronic platform which connects the multiple systems operated by the organizations that make up a seaport and its supply chain, is suggested for this task. A full-fledged PCS will enable intelligent/secure exchange of information between public and private stakeholders to improve the efficiency and competitive position of Egyptian seaport communities. It will also optimize, manage, and automate smooth port and logistics processes through a single submission of data and by connecting transport and logistics chains. This will eventually reduce time to market (and congestion) through booking, handling, and tracking services.

In general, the benefits of the proposed PDM cannot be overstated as it is expected to help reduce port/container terminal congestion by directing the state of the system from a User Equilibrium (UE), that captures port/terminal customers' selfish choice behaviours, towards a more efficient System Optimum (SO) [28].

The expected result of this project is a strategic plan for the Egyptian maritime transport sector utilizing the concepts of horizontal and vertical integration under the envisioned context of Port Demand Management (PDM). Special attention will be given to the three national container companies, namely Alexandria Container and Cargo Handling Co. (ACCH) operating terminals at Alexandria and El-Dekheila Ports, Port-Said Container and Cargo Handling Co. (PCCH), and Damietta Container and Cargo Handling Co. (DCCH). The results will then be generalized to tackle the congestion problem at the port-level.

To address the highlighted gaps in current practice in transportation/port planning and attain the expected outcome of this project (i.e. functional Port Demand Management plan for Egyptian ports/container terminals), various quantitative and qualitative research methods and tools will be used, as described in the next section.

The chosen research methods including data collection, statistical analysis, and microsimulation modelling resemble the state-of-the-art and current practice in transportation planning and behaviour modelling research (i.e. they follow acceptable norms and practices in the field). The selected methods will allow the research team to study the port congestion phenomenon and identify its causes, test different what-if scenarios, and prescribe an implementation PDM strategy that will help direct some shipping lines that cause congestion to other terminals.

Research Design and Methods (max. four pages)

Creating synergy between ports range from increasing the attractiveness for cargo throughput to strengthening the negotiation power confronted with carriers, politicians, or investors. To save financial resources, synergy offers the potential to speak with one voice in approaching investors and to reduce their investment risk by offering future oriented service concepts.

During the process of considering possible forms of synergy, the role of ports in maritime supply chains always consider their fixed locations. It is the shipping line or their customers who choose the port not the port who chooses carriers. Terminal operators as private companies are more flexible in their business outline by expanding to other locations through acquiring terminal concessions. Therefore, port authorities and terminal operators will profit from synergy creation to different extents.

In particular, port authorities and terminal operators (i.e. planners/policy makers) could alter customer decisions through the following twofold approach: First, understand what factors affect their port/terminal choice. Second, provide customers with incentives (disincentives) to attract (repel) them to (from) a certain port/terminal.

This research project will start with a **comprehensive literature review** on port congestion, its main reasons and impact. In addition, the **literature review** will also cover the concepts of horizontal and vertical integration, their various types and forms, the main factors and conditions affecting port integration, and successful applications of these concepts around the world.

Current and historical freight traffic **data will be collected** along a reasonable timeframe (e.g. 10 years) from different sources (e.g. the Egyptian Maritime Sector, MRCC publications, and on-line databases). Further, a **longitudinal study** (a quantitative research undertaking that involves repeated observations over a period of time) will be adopted to analyze the market shares of Egyptian container terminals and compare them among themselves and with their competitors in the region. A

cross-sectional study (an observational study that analyzes data at a specific point in time) will then be conducted to examine existing capacities at the three national container terminals including their infrastructure (e.g. berths, yards, etc.) and superstructure (e.g. cranes and gantries). Furthermore, points of strength and weakness of the companies' ability to utilize their capacities will be analyzed to identify the locations of bottlenecks in the process (i.e. across terminal and along roads) and benchmark their performance (e.g. operating and waiting time) against international standards. A **microsimulation model** will be developed (i.e. estimated, calibrated, and validated) to achieve the latter task. The microsimulation model will provide a replica of the port/container terminal by bringing together infrastructure, equipment, people, and automatic control systems. After developing a base model for the system, it will be used to examine different what-if/policy scenarios.

In addition, a **survey instrument design**, mainly **Revealed Preference (RP)** and **Stated Preference (SP)** surveys, will be used to gather information on customers' (e.g. shipping lines, cargo owners, etc.) choice behaviour utilizing **online questionnaires** and **in-person interviews [29]**.

On the one hand, research has shown that RP data may have substantial amount of noise for different reasons such as the measurement error. For example, an individual self-report of an actually made decision (e.g. a choice) is likely to be uncertain. Such uncertainty probably increases as the time between the actual choice and the report of that choice increases. On the other hand, SP experiments are usually generated by some systematic and planned design process in which the attributes and their levels are pre-defined without measurement error and varied to create preference or choice options. Nevertheless, SP responses are stated and not actual, and hence are uncertain because individuals may not actually choose the alternatives that they select during the experiment. Hence, both methods may have potential for error. Therefore, mixing RP and SP data may be more beneficial [30-33].

This research will combine RP and SP methods to make use of their advantages and reduce their individual drawbacks [34]. In particular, RP surveys will be used to collect factual information on customers (e.g. name, ports of operation, cargo types and volumes, etc.). In addition, SP experiments will be used to study the main factors that attract (repel) the most important shipping lines to (from) the Egyptian container and cargo handling companies. Each participant will face 6-8 hypothetical choice tasks (of the same operational attributes and different attribute levels) and will be asked to choose the most suitable option (i.e. container terminal) from his viewpoint.

Similarly, both online questionnaires and in-person interviews will be used to maximize their advantages and minimize their individual drawbacks. Research has shown that in-person interviews result in a higher response rate than online surveys. Many people who would ignore a questionnaire are willing to talk, with an interviewer who is obviously interested in this what they have to say.

The collected dataset will then be used to develop **discrete choice models** of mode switching behaviour that will help:

- Understand customers' choice preferences and the trade-offs that carriers/shippers make while choosing a port/terminal of call.
- Forecast customers' choices in response to system changes (e.g. increasing the draft, crane gross moves per hour, etc.).

Moreover, a **PESTLE Analysis** (a tool used by marketers to analyse and monitor the macro-environmental) will be conducted to examine the various external factors (i.e. Political, Economic, Social, Technological, Legal, and Environmental) that may have an impact on ports/container terminals. These conditions or factors will be analyzed through an **exploratory study** with the help of **focus groups** to identify the most relevant factors that influence such a decision then use the **priority matrix** to explain and present the most appropriate factors regarding their likelihood of occurrence and their impact. Then the study will analyse the most important factors and conditions that must be met for ports to benefit from synergy effects under **Port Demand Management (PDM)**.

SWOT analysis (a strategic planning technique used to help identify Strengths, Weaknesses, Opportunities, and Threats related to business competition) will be conducted for each container terminal as well as a **review of the country regulations and laws** in order to ensure the compliance of the three national terminals and how they are affected.

Assuming matching conditions of integration on the terminals, the next step will be to determine the most appropriate decision for companies, either continuous competition or forming some form of synergy, so **Game Theory** will be performed as a mathematical method to compare those two alternatives in order to find which decision will achieve the highest market share, in addition to determine the best form of integration, whether vertical or horizontal one or both of them.

Finally, various PDM policies (i.e. incentives/disincentives to redirect customers to the offered options and reschedule services to off-peak hours in attempt to reduce demand on congestion ports/container terminals) will be prescribed to best utilize existing asset without a need to invest in new infra- and super-structure.

Anticipated Results and Evaluation Criteria (Max. three pages)

We live in a world that suffers from scarcity of resources but blessed with abundance of information; a privilege only to those who are able to track down and scrutinize the information that would build up to the knowledge they need to acquire, so as to reach the optimal decision or solution. This is where statistics play an immense role in the process of pinpointing data, employing the correct analysis methods and effectively presenting accurate results that would remarkably enhance development and make the goal of this research attainable.

To address the highlighted gaps in the current practice in transportation/port planning and attain the expected global outcome of this project (i.e. functional Port Demand Management plan for Egyptian ports/container terminals), various quantitative and qualitative research methods and tools will be used for data analysis and evaluation.

Data Analysis and Evaluation

Statistical and/or logical techniques will be systematically applied through the entire data collection phase of this project to describe and illustrate, condense and recap, and evaluate collected data. Such analytical procedures will provide a way of drawing inductive inferences from data and distinguishing the signal (the phenomenon of interest) from the noise (statistical fluctuations) present in the data. In more precise terms, the efficiency of data analysis and evaluation in this project will be maintained through the following:

1) Ensuring that investigators have the necessary skills to deal with data. Selected MRCC team members for this project have received training sufficient to demonstrate a high standard of research practice and to collect, enter, store, and analyze data.
2) Selecting data collection methods and appropriate analysis. While analytical methods may differ by scientific discipline, the optimal stage for determining appropriate analytic procedures occurs early in the research process (i.e. during the initial planning) and should not be an afterthought. In this research, data collected methods are already identified and presented in the previous section such as Revealed Preference (RP) and Stated Preference (SP) survey methods and discrete choice modelling, to name a few. The selected methods follow acceptable norms and practices in the Transportation/Port Planning field.
3) Determining reliability, validity, and significance. Data reliability and validity will be critically examined including the chosen sample size, techniques being used, and the generalizability of results. In addition, while the conventional practice is to establish a standard of acceptability for statistical significance, this research will also discuss whether attaining statistical significance has a true practical meaning.

An essential component of ensuring data integrity is the accurate and appropriate analysis of research findings. Improper statistical analyses distort scientific findings, mislead casual readers, and may negatively influence public perception of research. Integrity issues are just as relevant to analysis of non-statistical data as well.

Research Anticipated Results and Evaluation

The global outcome of this research is a new paradigm for a more holistic port planning approach called "*Port Demand Management (PDM)*". An action plan will be provided to port authorities/container companies to offer customers (e.g. shipping lines) alternative options where underutilized assets exists. To entice customers change their choices, incentives/disincentives will be provided to redirect them to the offered options and/or reschedule services to off-peak hours in attempt to reduce

demand on congestion ports/container terminals. This will be achieved with the help of Information Technology (IT) to reduce human involvement in operations through automation and/or ensure the rapid and accurate transfer and processing of the enormous amounts of data processed in ports/container terminals.

The evaluation criteria do not end with just data collection and analysis to find out results or a degree of satisfaction, but rather the evaluation will use these results as a base for some value judgments to be made for the anticipated results of the project. Five evaluation criteria are suggested for the global outcomes of this project, namely relevance, effectiveness, efficiency, impact, and sustainability.

a) **Relevance:** The extent to which the objectives of the project are consistent with the beneficiaries' requirements, country needs, and partners' and donors' policies. Relevance will be evaluated through answering the following questions. (1) Are we doing the right thing? (2) Does the experimental design reflect the strategic development needs of national container terminals? (3) How important are the project outcomes to the local and national requirements and priorities?

b) **Effectiveness:** The extent to which the project's objectives were achieved, or are expected to be achieved, taking into account their relative importance. Effectiveness will be evaluated through answering the following questions: (1) Are the activities being performed likely to achieve planned objectives and outcomes as enunciated in the project document? (2) Have the beneficiaries' knowledge, understanding, and capacity been improved? (3) How significant is the impact of the project compared to the objectives planned?

c) **Efficiency:** A measure of how economically resources/inputs (e.g. funds, expertise, time, etc.) are converted into results. Efficiency will be evaluated through answering the following: (1) Are objectives being economically achieved by the project? (2) How large is the utilisation ratio of the used resources? (3) Have project internal monitoring and control ensured the achievement of the expected outcomes on time and on budget? (4) Has the project leveraged in-house expertise, previous research and technical cooperation outcomes, existing databases, and other internal resources of the AASTMT?

d) **Impacts:** The positive and negative, primary and secondary long-term effects produced by the project, directly or indirectly, intended or unintended. Impacts will be evaluated by answering the following questions: (1) Does the project contribute to reaching higher level development objectives? (2) What is the effect of the project in proportion to the overall situation of the affected target group?

e) **Sustainability:** The continuation of benefits from the project after it has been completed. The probability of long-term benefits. The resilience to risk of the net benefit flows over time. Sustainability will be evaluated by answering the

following: (1) Are the developed models and research findings transferrable to the real-world? (2) How is the permanence of the project and its effects to be assessed? (3) To what extent have project beneficiaries' institutional capacities been enhanced? (4) Have efforts been made to sustain the knowledge/capacity gained during the project for future projects to be carried out by AASTMT?

Expected Project Outcomes and Impact to AASTMT (Max. two pages)

I-Technical output and Impact:

The expected tangible outcomes of this research include a technical report that covers the literature review, Egyptian container terminals market analysis, Egyptian container terminals operation efficiency and effectiveness assessment, and a strategic port planning approach to increase the market share for Egyptian container terminals in the region. Also, one graduate student will receive a M.Sc. degree in the field of transport/port planning where his thesis will be an output of the project.

II- Financial feasibility & Socio-economic Impact:

In view of the future role of the maritime sector in Egypt and the expected growth over the upcoming years, the social, economic, and environmental impacts of this project are significant. This project will result in the development of a practically sound approach to port planning (i.e. Port Demand Management). We envisage collaborations with multidisciplinary groups from both the public and private sectors (collaboration with the three national container terminals has already been established). This will promote a wide range of knowledge-based applications in the Egyptian maritime industry and planning decisions at different levels of government. Potential beneficiaries of this research are local/regional governments, private industries, the Maritime Transport Sector, and the Ministry of Transportation.

Being the flagship of Maritime Transport education and research in Egypt and the Arab world, the AASTMT is expected to invest in this topic given its strong practical implications on the Egyptian Maritime Transport Sector and the national economy at large. This project will develop new ideas that serve AASTMT strategic research plan to produce new knowledge through scientific research. In turn, this project will promote Research and Development (R&D) projects that contribute to the achievement of sustainable development within the AASTMT.

III – Publication:

The expected outcome of this project is at least one peer-reviewed original research paper accepted for publication (received a DOI) in a Q1-Q2 Scopus indexed journal or its equivalent.

Resources (Max. two pages)

Personnel

MRCC research team has achieved success along the way given our wide expertise in transportation engineering and planning, ports and terminal operation, shipping lines work, IT applications in the maritime sector, analytical research in the maritime sector, strategic analysis, quantitative and qualitative research methods, feasibility studies, corporate social responsibility, and performance evaluation. In addition, MRCC manages and edits the Maritime Scientific Research Journal.

Our research group meets regularly once a week where a team member presents his/her work and discusses the findings/issues with the rest of the team. Other MRCC colleagues, academic/industry visitors, and graduate students are some times invited to attend these meetings (in person or via conference calls) for knowledge transfer. From the outset, we sought transparency, fairness, and inclusiveness in the team building processes and outcomes. Initially we were very candid (with trust increasing over time) in sharing opinions on the project's likelihood for success, personal difficulties due to health, family, or work conflicts, and personal interests in a particular project. Across team members, the different demands in our personal and professional lives are recognized and respected. At each meeting members always begin with “social updates” and sharing what was done for fun over the past week.

Through publications in high-impact journals and high-visibility book chapters, our team seeks to advance Maritime Transport research, develop Maritime Transport industry, and fulfil the Maritime Research and Consultant Center (MRCC) and the Arab Academy for Science, Technology and Maritime Transport (AASTMT) missions to create and disseminate knowledge. In addition, MRCC holds a monthly research seminar where industry professionals are invited to present recent trends in the field.

Laboratory Space

MRCC does not have a computer lab to date. However, there exists a space of about 25 m^2 dedicated to become a computer lab. In addition, MRCC has a meeting room of about 50 m^2 equipped with a conference table that accommodates 12 people. However, some office equipment, computer facilities, and software packages are deemed crucial to the successful completion of this research project, as presented in the research equipment section below.

Team Information (Max. of one page per team member)

Dr. Ahmed Osman Idris, P.Eng. Dean, Maritime Research and Consultation Center (MRCC)	Dr. Idris is an Associate Professor of Transportation Engineering and Planning in the AASTMT and an Affiliate Professor in UBC's School of Engineering (Canada). **Research Domain:** Transportation Engineering and Planning Dr. Idris employs quantitative and qualitative research methods including: survey design and data collection, stated choice experiments, statistical analysis and discrete choice modelling, operations research, computer simulation, and Geographic Information Systems for Transportation (GIS-T). He is currently exercising his transportation planning and demand analysis expertise to develop a sequential demand forecasting model for maritime transport planning. He is also interested in seaport integration, port/container terminal choice modelling, intelligent maritime transport systems, and GIS solutions for port management.
Mr. Ahmed El-Sakhawy Researcher at the Economic and Managerial Studies Department, Maritime Research and Consultation Center (MRCC)	Ahmed El-Sakhawy holds a Bachelor of Commerce in accounting (English section) and M.Sc. in accounting and finance from Alexandria University, also he is a Certified Management Accountant (CMA) and is currently a researcher at the Economic and Managerial Studies Department (MRCC). Ahmed is the Assistant Managing Editor of the Maritime Scientific Research Journal (MSRJ), published by MRCC. His professional interests focus on feasibility studies preparation, teaching accounting and financial management, also his research interests include corporate governance, corporate social responsibility, and performance evaluation.
Ms. Ghada Zaky, MBA Information Technology Researcher, Maritime Research and Consultation Center (MRCC)	Ghada is an IT consultant specialized in Maritime Transport. **Research Domain:** Smart and Green Ports, IOT, Blockchain, Bigdata, Applying new technology in ports. Ghada employs quantitative research methods including: survey design and data collection, statistical analysis. As part of her DBA dissertation, she is currently exercising her technology and business experience to develop an adoption acceptance model for IOT technology in Egypt.

Ms. Salma Abd El Kader El Saadani Researcher at the Economic and Managerial Studies Department, Maritime Research and Consultation Center (MRCC)	Salma El Saadani has a Master Degree in International Transport & Logistics, a BS in Business Administration. **Contributed in the following Studies:** 1- A Strategic Plan for Developing State-Owned Container Companies (Alexandria / Port Said / Damietta) In Light Of Recent Challenges In The Maritime Transport Market. 2- Strategic Plan for Egyptian Ports 2030. 3- Feasibility studies for the establishment of a multi-purpose terminal at East Port-Said Port, Sesco Terminals.
Ms. Mona Mohamed Awad Researcher at the Economic and Managerial Studies Department, Maritime Research and Consultation Center (MRCC)	Mona is an Analytical Research Specialist in Maritime Research and Consultation Centre, AASTMT (Egypt) and an Affiliate teacher's Assistant in AASTMT (Cairo, Port Said branches). Research Domain: (1) maritime transportation and logistics strategic planning; (2) market analysis. (3); Financial Accountancy and Financial Analysis techniques; (4) Cost Structure model; and (5) feasibility studies preparation. Mona is interested in applying strategic analysis tools and techniques to provide a full description of the current strategic position of seaports and container terminals in the market compared to competitors. In addition, she applies statistical methods in developing sequential decision & demand forecasting models for maritime transport planning. Also, she uses financial analysis tools in selecting the most profitable projects.
Ms. Rania Saad Aboulhassan Researcher at the Economic and Managerial Studies Department, Maritime Research and Consultation Center (MRCC)	• Master degree of International transport & Logistics – Arab Academy for Science, Technology and Maritime Transport 2016. • Diploma of International transport & Logistics – Arab Academy for Science, Technology and Maritime Transport 2013. • Bachelor's of Accounting (Faculty of Commerce), Alexandria University, Accounting Studies Department 2001.
Mr. Mohamed Hussein Darwish Researcher at the Economic and Managerial Studies Department, Maritime Research and Consultation Center (MRCC)	Mr. Darwish is a Researcher at the Economic and Managerial Studies Department, MRCC with Technical Experience in Maritime Transport, container shipping lines, ports and terminals operation, and Marine Survey. In addition, Mohamed holds a Master degree in International Transport & Logistics – Arab Academy for Science, Technology and Maritime Transport 2019. **Research Domain:** (1) Ports and Terminal operation, (2) Ports and Terminals data analysis and (3) Logistics Strategic planning.

Research Team Information Table

Name of Res. Team Member in English	Name of Res. Team Member in Arabic	University / Institute in English	Position / Title	%of time spent on project	No. of months	Incentive per month (LE)	Number of other projects and their IDs	Total % of time spent on other projects	Contact No.
Dr. Ahmed Osman Idris (PI)	د. أحمد عثمان إدريس	AASTMT/ MRCC	Dean, MRCC	10%	12	1,667	-	-	010-99384898
Mr. Ahmed Ayman El-Sakhawy	أ. أحمد ايمن السخاوى	AASTMT/ MRCC	Researcher, MRCC	15%	12	1,042	-	-	011-13039761
Miss. Ghada Zaky	أ. غادة زكى	AASTMT/ MRCC	Researcher, MRCC	15%	12	1,042	-	-	011-25766066
Mr. Mohamed Hussein Darwish	أ. محمد حسين درويش	AASTMT/ MRCC	Researcher, MRCC	15%	12	1,042	-	-	012-21450188
Miss. Mona Mohamed Awad	أ. منى محمد عوض	AASTMT/ MRCC	Researcher, MRCC	15%	12	1,042	-	-	012-00024549
Mrs. Rania Saad Aboulhassan	أ. رانيا سعد أبو الحسن	AASTMT/ MRCC	Researcher, MRCC	15%	12	1,042	-	-	010-01723478
Mrs. Salma Abd El Kader El Saadani	أ. سلمى عبد القادر السعدنى	AASTMT/ MRCC	Researcher, MRCC	15%	12	1,042	-	-	010-06633657

Project Management (Max. three pages)

Project monitoring will be attained via weekly research team meetings, while the daily communication will be through emails. Progress reports and statistics will be created to monitor the overall progress of the project during all phases. Project management will be undertaken using Microsoft Project and other Microsoft Office products.

The project manager will be responsible for the following tasks:

1) Monitor project planning parameters: follow up on performance indicators including effort, cost, schedule, timeline, etc. while the project proceeds forward.
2) Monitor commitments: keep track of the commitments of different team members.
3) Monitor project risks: track all the risks that might be involved within the project and execute mitigation strategies (e.g. having Plan B ready, backups, etc.). There are various types of risks that can be involved in a project, including process, people, technology, tools, etc.

4) Data management: monitor all configuration items which include software, hardware, as well as documentation of the project.
5) Progress reviews: conduct and manage the project progress reviews with the help of different techniques which includes the work progress of team members, milestones, etc. Based on these activities, status reports will be created.
6) Manage actions to closure: based on the progress of the project, it is important to take corrective actions to get control over the progress of the project plan. These corrective actions are then tracked till the project closure.

This project is divided into the following four main Work Packages (WP): literature review, market analysis, container terminal operation efficiency and effectiveness assessment, and strategic port planning approach to increase the market share for Egyptian container terminals in the region and finalizing the final report.

WP1: Literature Review

A Literature review will survey scholarly sources of definitions and bonds between the types of port integration (vertical and horizontal integration). This will provide an overview of current situation and current knowledge and will allow the research team to identify relevant theories, methods, and gap in current practice.

The literature review will involve finding relevant publications such as journal articles, technical reports, and textbooks that discuss the concepts of port integration and port demand management. Publications will then be analysed and the findings will be explained through the following steps: Search, Evaluate, Identify, Outline, and Write.

Preliminary literature review emphasized the importance of port integration in the supply chains, stating that the role of port outpaces the simple function of transhipment and that ports became a place for value added logistics and ports should grow from the traditional functions of facilitating loading and discharging operations in order to become links in a complex logistics chain, hence the part of a global distribution network.

In this research we will study all the points and definitions that affect port integration, port congestion, and port demand management which will lead finding results and effective recommendations. Literature review activities will be coordinated among team members following the schedule below:

GANTT CHART

	Task Name	Duration	Start	Finish	Pr	Team Members
1	**Towards an Integrated Egyptian Maritime Transport Sector: Horizontal and Vertical Integration of Egyptian Commercial Ports**	**265 days**	**Sun 5/16/21**	**Thu 5/19/22**		
2	**Literature review**	**125 days**	**Sun 5/16/21**	**Thu 11/4/21**		
3	Investigating Congestion Reasons	40 days	Sun 5/16/21	Thu 7/8/21		Rania Saad,Salma ElSaadny
4	Investigating Integration Methods	40 days	Sun 7/11/21	Thu 9/2/21	3	Ghada Zaky,Mona Awad
5	Exploring Demand Management Port System	40 days	Sun 9/5/21	Thu10/28/21	4	Ahmed ElSakhawy,Mohamed Darwish
6	Preparing Literature Review Report	5 days	Sun 10/31/21	Thu 11/4/21	5	Ahmed ElSakhawy,Dr. Ahmed Idris,Mohamed Darwish, Mona Awad

WP2: Market Analysis

A market analysis will be conducted for the three national Egyptian companies under study (Alexandria, Damietta, and Port Said Container and Cargo Handling Companies) to show their current situation by analyzing supply and demand at the local and regional levels. Then, companies' market shares will be determined and their strengths and weaknesses will be identified. The ability of each company to utilize its capacity will be discussed and finally a detailed market analysis report will be prepared. The activities of this work package will be coordinated by the team according to the following schedule:

GANTT CHART

	Task Name	Duration	Start	Finish	Pr	Team Members
7	**Market analysis**	**60 days**	**Sun 6/20/21**	**Thu 9/9/21**		
8	Analyze the performance of Alexandria, Port Said, and Damietta Container and Cargo Handling Companies and their market share.	15 days	Sun 6/20/21	Thu 7/8/21		Rania Saad,Salma ElSaadny
9	Analyze the network of shipping lines calling Egyptian ports and the development of the handling volumes (shares) of these lines with the three Egyptian companies.	15 days	Sun 7/11/21	Thu 7/29/21	8	Rania Saad,Salma ElSaadny
10	Capacity calculations of the container terminals under study.	10 days	Sun 8/1/21	Thu 8/12/21	9	Ahmed ElSakhawy,Mohamed Darwish,Mona Awad
11	Strengths and weaknesses analysis of the companies' ability to utilize their capacity	10 days	Sun 8/15/21	Thu 8/26/21	10	Ahmed ElSakhawy,Mohamed Darwish,Mona Awad
12	Submit a market analysis report	10 days	Sun 8/29/21	Thu 9/9/21	11	Ahmed ElSakhawy,Mohamed Darwish, Mona Awad,Rania Saad,Salma ElSaadny

WP3: Container Terminal Operation Efficiency and Effectiveness Assessment

This stage aims to address congestion problem in container terminals. Discrete-event simulation packages will be used to simulate the operation in berth, yard, and gates. Then, the research team will assess container terminal operation and determine locations of bottlenecks. Different what-if scenarios will be examined to find ways to increase throughput, improve equipment utilization, reduce waiting time and queue sizes, reduce bottlenecks, and balance workload by allocating resources efficiently.

This stage will start with collecting data required for the simulation (e.g. terminals infrastructure data, vessel schedule, and vessels technical information calling Egyptian container terminals, terminals layout, trucks schedule, etc.). Then the simulation will be estimated, calibrated, and validated. Finally, simulation results will be interpreted to provide actionable insights for congestion mitigation from operation planning point of view, which will integrate with the next study stages. The activities of this WP will be coordinated by the team according to the following schedule:

GANTT CHART

	Task Name	Duration	Start	Finish	Pr	Team Members
13	**Container terminal operation efficiency and effectiveness assessment**	**30 days**	**Sun 9/12/21**	**Thu10/21/21**	**12**	
14	Collect data	20 days	Sun 9/12/21	Thu 10/7/21	12	Ahmed ElSakhawy,Mohamed Darwish, Mona Awad, Rania Saad,Salma ElSaadny
15	Build the model	20 days	Sun 9/12/21	Thu 10/7/21		Ahmed ElSakhawy,Mohamed Darwish
16	Interpret the results	10 days	Sun 10/10/21	Thu 10/21/21	14	Ahmed ElSakhawy,Mona Awad,Mohamed Darwish

WP4: Strategic Port Planning Approach

This work package is intended to investigate the ability of integration between the terminals. The main factors and conditions that have an impact on port integration decisions will be determined using PESTLE Analysis, priority matrix, and exploratory tools. SWOT analysis will be conducted for each terminal and country regulations to ensure the compliance of the three terminals with the previous conditions. The most appropriate decision for companies will be determined (either continuous competition or forming horizontal/vertical integration or both of them) using Game Theory as a mathematical method. An investigation on the main factors that attract (repel) the most important shipping lines to (from) the Egyptian containers will be undertaken using Stated Preference experiments. Then, the study will investigate the ability of using "Port Demand Management (PDM)" with the help of Port Community System PCS – in case of being accepted integration- to offer customers one or more container terminal options of underutilized assets. Then, the final report will be put together. Activities of this WP will be coordinated according to the following schedule:

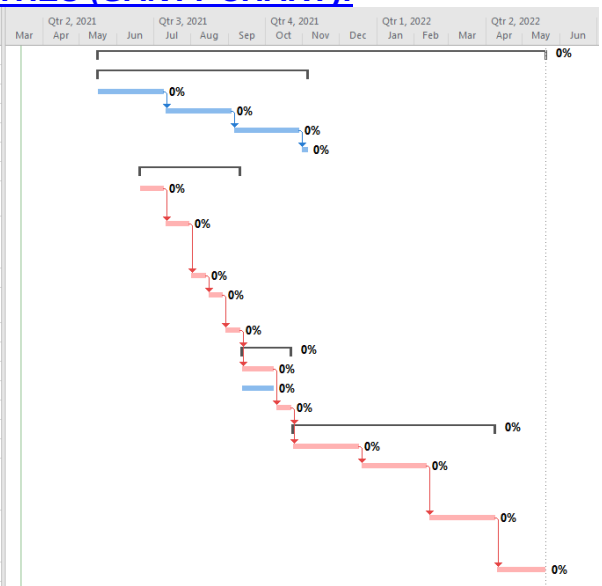
GANTT CHART

	Task Name	Duration	Start	Finish	Pr	Team Members
17	**Proposed Strategic Port Planning Approach to increase the market share for Egyptian container terminals in the region**	**120 days**	**Sun 10/24/21**	**Thu 4/7/22**	**16**	
18	Investigate the ability of integration between the terminals:	40 days	Sun 10/24/21	Thu 12/16/21	16	Ghada Zaky,Mona Awad,Ahmed ElSakhawy
19	Investigate the main factors that attract (repel) the most important shipping lines to (from) the Egyptian containers with using a stated Choice Experiments.	40 days	Sun 12/19/21	Thu 2/10/22	18	Mohamed Darwish,Rania Saad,Salma ElSaadny
20	Investigate the ability of using Port Demand Management (PDM)" with the help Port Community System "PCS" – in case of being accepted integration- to offer customers one or more container terminal options of underutilized assets.	40 days	Sun 2/13/22	Thu 4/7/22	19	Ahmed ElSakhawy,Mona Awad,Ghada Zaky
21	Preparing the final Report	30 days	Sun 4/10/22	Thu 5/19/22	20	Ahmed ElSakhawy,Dr. Ahmed Idris,Ghada Zaky, Mohamed Darwish,Mona Awad,Rania Saad,Salma ElSaadny

DETAILED PLAN ON PROJECT'S ACTIVITIES (*GANTT CHART*):

TRACKING GANTT

	Task Name	Duration
1	**Towards an Integrated Egyptian Maritime Transport Sector: Horizontal and Vertical I**	**265 days**
2	**Literature review**	**125 days**
3	Investigating Congestion Reasons	40 days
4	Investigating Integration Methods	40 days
5	Exploring Demand Management Port System	40 days
6	Preparing Literature Review Report	5 days
7	**Market analysis**	**60 days**
8	Analyze the performance of Alexandria, Port Said, and Damietta Container and Cargo Handling Companies and their market share.	15 days
9	Analyze the network of shipping lines calling Egyptian ports and the development of the handling volumes (shares) of these lines with the three Egyptian companies.	15 days
10	Capacity calculations of the container terminals under study.	10 days
11	Strengths and weaknesses analysis of the companies' ability to utilize their capacity	10 days
12	Submit a market analysis report	10 days
13	**Container terminal operation efficiency and effectiveness assessment**	**30 days**
14	Collect data	20 days
15	Build the model	20 days
16	Interpret the results	10 days
17	**Proposed Strategic Port Planning Approach to increase the market share for Egypt**	**120 days**
18	Investigate the ability of integration between the terminals:	40 days
19	Investigate the main factors that attract (repel) the most important shipping lines to (from) the Egyptian containers with using a stated Choice Experiments.	40 days
20	Investigate the ability of using Port Demand Management (PDM)" with the help Port Community System "PCS" – in case of being accepted integration- to offer customers one or more container terminal options of underutilized	40 days
21	Preparing the final Report	30 days



Allowable Project Costs (Max. two pages)

i. Personnel costs

	Position	Level of Effort	Cost (L.E.)
1	Project Director / Transport Engineering & Planning	20%	20,000
2	Researcher / Strategic Planning Specialist	12.5%	12,500
3	Researcher / Marketing Specialist	12.5%	12,500
4	Researcher / Logistics Specialist	12.5%	12,500
5	Researcher / Information Technology Specialist	12.5%	12,500
6	Researcher / Modelling Specialist	12.5%	12,500
7	Researcher / Financial Specialist	12.5%	12,500
8	Administrative Assistant / Coordinator	5%	5,000
Total		**100%**	**100,000**

Justification

1) The Project Director will provide daily oversight of the grant, review progress and submissions, and will facilitate the successful completion of the project.
2) The Administrative Assistant / Coordinator will coordinate project services and project activities including meeting arrangements, typing general correspondence, etc.
3) The Researchers will provide necessary day to day operation of this project.

ii. Mobility costs (internal travel/subsistence expenses), should not exceed 5%.

Purpose of Travel	Location	Item	Rate	Cost (L.E.)
Collect data on ACCH	Alexandria	Transportation	125 LE / trip x 2 trips / day x 3 days	750
		Meals / Incidentals	150 LE /day x 3 persons x 3 days	1,350
Collect data on PCCH	Port Said	Transportation	1,000 LE /day x 3 days	3,000
		Hotel	600 LE/night x 3 persons x 2 nights	3,600
		Meals / Incidentals	300 LE /day x 3 persons x 3 days	2,700
Collect data on DCCH	Damietta	Transportation	1,000 LE /day x 3 days	3,000
		Hotel	600 LE/night x 3 persons x 2 nights	3,600
		Meals / Incidentals	300 LE /day x 3 persons x 3 days	2,700
Validate and verify simulation model	Alexandria ACCH	Transportation	125 LE / trip x 2 trips / day x 2 days	500
		Meals / Incidentals	150 LE /day x 2 persons x 2 days	600
Validate	Port Said	Transportation	1,000 LE /day x 1 days	1,000

and verify simulation model	PCCH	Meals / Incidentals	300 LE /day x 2 persons x 1 days	600
Validate and verify simulation model	Damietta DCCH	Transportation	1,000 LE /day x 2 days	1,000
		Meals / Incidentals	300 LE /day x 2 persons x 1 days	600
Total				**25,000**

Justification
Local travel is needed to collect data, attend local meetings, and other project activities.

iii. Costs related to organizing seminars and workshops within the project

Through the study, MRCC team will organize two major events. A workshop will be organized to collect data from stakeholders (mainly industry experts) and a seminar will be organized to discuss preliminary result, acquire feedback, and improve the study output.

Event	Estimated Cost (L.E.)
Workshop	7,500
Seminar	7,500
Total	**15,000**

iv. Acquisition of material and small-scale research equipment

Item	Units	Description	Estimated Cost (L.E.)
PC	6	CPU: Intel i7 - 7700k RAM: 16GB DDR4 Graphics: NVidia GeForce GTX 1,060	96,000
Monitor	6	HP Integrated speakers (1920 x 1080)	30,000
Data Show	2	Epson Projector (for lab and meeting room)	26,000
Smart Board	1	Smart board Tacteasy	22,000
PC Workstation Table	6	IKEA or similar	36,000
Press Conference Microphone System	1	Twelve channel wireless microphone system including 12 table top mics and rack mountable receiver base	15,000
Drawer Unit	6	IKEA or similar	24,000
Hydraulic Chair	6	IKEA or similar	21,000
Total			**270,000**

Justification

To conduct data analyses, statistical modelling, and computer simulation, the study team will need well equipped laboratory that can cope with the requirements of the software packages needed during the study.

Breakdown of Costs Other Grant(s) (Max. two pages)

Table of Eligible Costs

Eligible costs	Breakdown		AASTMT Support (L.E.)
(A) Staff Cost	PI		20,000
	Researchers		75,000
	Administrative Assistant / Coordinator		5,000
	Total		**100,000**
(B) Equipment	Equipment		270,000
	Spare Parts		20,000
	Total Equipment		**290,000**
(C) Expendable Supplies & Materials	Stationary		5,000
	Miscellaneous Laboratory, Field supplies, Materials		20,000
	Total Expendable Supplies & Materials		**25,000**
(D) Travel	Internal Transportation		9,250
	Accommodation		15,750
	Total Travel		**25,000**
(E) Other Direct Costs	Services	Acquiring access to specialized reference sources databases or computer software	30,000
	Report preparation		10,000
	Publications & Patent Costs		5,000
	Workshops Organization or Training		15,000
	Others (explain)		
	Total Other Direct Costs		**60,000**
(F) Total Costs			**500,000**

Plans for Disseminating Research Results / Sustainability of the action (Max. three pages)

This project opens the door for a number of potential projects and researches. As the East Mediterranean region is highly competitive when it comes to maritime transport, and there is periodic information available about vessels dwell and turnover rates, and reasons behind the decline in performance rates in some of the Egyptian ports in

comparison with the competing ports of the region and trying to find remedies for this decline is considered a very fertile field for further future studies and experimenting.

Moreover, the expansion in the usage of PDM concept for achieving integration between the ports would help in limiting unnecessary spending on investments in infrastructure and superstructure. As well as achieving the optimum utilization of idle capacity would be a beneficiary outcome for all parties involved on the long run. This also may lead to the use of the PDM on a wider scope in the future as to include the port as a whole not only the container terminals.

It may also be a foundation for mutual cooperation on a regional level between Egyptian ports and some of the foreign ports of the region. Furthermore, it would also enhance vertical integration between the port and the shipping lines and the logistics services companies.

Accordingly, reports and results from this project as well as that extracted from the simulation model developed during this project, may all be used in several future projects, research papers, and workshops reflecting the role adopted by the AASTMT in enriching scientific research and the vital part it plays in solving the Maritime Transport industry problems in practice:

Research Dissemination Plan

Through the study, MRCC team will organize workshops and seminars to collect data from stakeholders, discuss preliminary results, acquire feedback, and improve the study output. It is planned that reports and research findings will be published in a phased manner every 3 months in four phases during the timespan of the project:

Phase 1:
- Literature review report
- Market analysis for the Egyptian container terminals report

Phase 2:
- Container terminal operation efficiency and effectiveness assessment report

Phase 3:
- Proposed strategic port planning approach to increase the market share for Egyptian container terminals in the region (initial report)

Phase 4:
- Proposed strategic port planning approach to increase the market share for Egyptian container terminals in the region (final report)
- One peer-reviewed original research paper accepted for publication (received a DOI) in a Q1-Q2 journal or its equivalent

Key Publications and references (Max. two pages)

1. Chinedum, O., *Port congestion determinants and impacts on logistics and supply chain network of five African ports.* Journal of Sustainable Development of Transport and Logistics, 2018. **3**(1 (4)).
2. Meersman, H., E. Van de Voorde, and T. Vanelslander, *Port congestion and implications to maritime logistics*, in *Maritime Logistics*. 2012, Emerald Group Publishing Limited.
3. Meersman, H., E. Van de Voorde, and T. Vanelslander, *Port competition revisited.* Journal of Pediatric, Maternal & Family Health-Chiropractic, 2010. **55**(2): p. 210.
4. Balliauw, M., P.M. Kort, and A. Zhang, *Capacity investment decisions of two competing ports under uncertainty: A strategic real options approach.* Transportation research part B: Methodological, 2019. **122**: p. 249-264.
5. Balliauw, M., et al., *The case of public and private ports with two actors: Capacity investment decisions under congestion and uncertainty.* Case Studies on Transport Policy, 2020. **8**(2): p. 403-415.
6. Hanson, S.E. and R.J. Nicholls, *Demand for ports to 2050: Climate policy, growing trade and the impacts of sea-level rise.* Earth's Future, 2020. **8**(8).
7. Wang, J.J., *Ports, cities, and global supply chains*. 2007: Ashgate Publishing, Ltd.
8. Elsaih, M. and K.M. Salem, *The Impact of Horizontal Integration on Mediterranean Container Port Competitiveness.* International Journal of Scientific & Engineering Research, 2018. **9**(9): p. 1689-1694.
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10. Álvarez-SanJaime, Ó., et al., *Vertical integration and exclusivities in maritime freight transport.* Transportation Research Part E: Logistics and Transportation Review, 2013. **51**: p. 50-61.
11. Kia, M., E. Shayan, and F. Ghotb, *The importance of information technology in port terminal operations.* International Journal of Physical Distribution & Logistics Management, 2000.
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16. MTS, *The Egyptian Maritime Transport Strategy, Development & Increasing the Competitiveness of Ports*. 2018, Maritime Transport Sector.
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19. WB, *Egypt: Enabling Private Investment and Commercial Financing in Infrastructure*. 2018: World Bank.
20. Haralambides, H.E., *Competition, excess capacity, and the pricing of port infrastructure.* International journal of maritime economics, 2002. **4**(4): p. 323-347.
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22. Hoshino, H., *Competition and collaboration among container ports.* The Asian Journal of Shipping and Logistics, 2010. **26**(1): p. 31-47.
23. Guo, L., D. Yang, and Z. Yang, *Port integration method in multi-port regions (MPRs) based on the maximal social welfare of the external transport system.* Transportation research part A: Policy and practice, 2018. **110**: p. 243-257.
24. Wang, C., C. Ducruet, and W. Wang, *Port integration in China: Temporal pathways, spatial patterns and dynamics.* Chinese geographical science, 2015.
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Declaration of original submission and Other Grant(s) (Max. one page)

I/We declare that this proposal did not and will not be submitted in whole or part for funding; twice within the same cycle, or to other funding programs within AASTMT, or other funding agencies.

Acknowledgment Form: *Please copy this section, sign and scan it as a part of your proposal*

By signing below, I acknowledge that I have read, understand and accept to comply with all the terms of the foregoing application, mentioned in AASTMT general conditions and guidelines for submitting a research proposal, including, but not limited to:

- The total number of the application pages should not exceed **30 pages** excluding a cover page, as well as all sections of the proposal (as mentioned in AASTMT General Conditions and Guidelines for Submitting Research Proposal).
- At any time, a contracted AASTMT project team member should only be participating in a maximum of one project.
- Allowable budget maximum limit should be strictly adhered to in the project proposal. In all cases, requested budget has to be justified in detail.
- AASTMT guidelines, IPR rules, code of ethics, etc. (www.aast.edu), should be read carefully and adhered to. These are integral parts of the contract.
- All proposals – in addition to PI and other data - must be uploaded to the AASTMT website by the designated deadline. Uploaded PI data should conform to the corresponding data in the application form.

Applications will not be considered eligible and will be discarded in the following cases:

- Proposals submitted by e-mail or sent as hard copies or uploaded to the AASTMT website after the deadline.
- Proposals not conforming to the designated format.
- Proposals whose uploaded PI data does not conform to PI data in the proposal file.
- Proposals in which the allowable budget maximum limit has been exceeded.
- Proposals in which maximum allowable contracted AASTMT project participation limit has been exceeded.
- Proposal letter does not include a scanned copy of the signed and stamped PI institution endorsement letter in case of team member work outside AASTMT.
- Proposal does not include a scanned copy of the signed acknowledgment form.

Date & Signature: March 15th, 2021

MRCC Dean

Dr. Ahmed Osman Idris, P.Eng.