

**INFORMATION TECHNOLOGY IN MODERN PORT  
MANAGEMENT**

**(ECONOMIC PRESPECTIVE)**

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**ABSTRACT**

Suez Canal and ports are areas of major economic strength to the Egyptian economy. Development plan and functions of ports should be based on economic development, as shortage of ports capacity and functions may limit economic development. Smart ports using intelligent exchange of information increase the quality and efficiency of ports through digitization and automation, which increase role of ports in the economy, which recommend further advancement of ports towards more economic development. The paper selects four leading ports based on their ICT development to study the benefits of ports automation and their impact on economic development. Then the paper will study the status of Egyptian ports trying to reach a SWOT analysis of implementation of advanced ICT systems in Egyptian ports ending with presenting some conclusions and recommendations towards Egyptian ports automation.

**Keywords:** Smart, Port, Economic, Development, Automation, Egypt, Performance

**INTRODUCTION**

A port becomes a wheel of economy if it runs efficiently as the function of a port has expanded to a logistical platform. The efficiency of a port is important in international trade since a seaport is the nerve of foreign trade of a country (TIWARI, 2011). Ports are required to adapt to technological and commercial change as the increasing volume of international transport, combined with all kinds of offshore activities, is resulting in increasing shipping intensity in ports, which accompanied with the development of extremely large ships.

Significant increases in port throughput put pressures for the development of ports infrastructures based on a smart approach for cost effective, sustainable, and

safe designs, smart to operate the port efficiently and smart to make port operations more environmental friendly.

The current study focus on information and communication technologies in ports worldwide and how they affect port performance and economic development.

### **FIRST: PORTS AND ECONOMIC DEVELOPMENT**

Economic development term returns back to late 18<sup>th</sup> century with emergence of capitalism, it was first associated with a sustained increase of per capita income. In the 20<sup>th</sup> century, development linked to the raise of welfare with social movements in industrial societies. In early 21<sup>st</sup> century, development linked to set of issues including social equity and environmental sustainability (Brox, 2014). Economists are looking at what role the efficiency and effectiveness of port activities can play on regional development (Ferrari et al, 2012). Adam Smith (1776) argued that; “As by means of water-carriage, a more extensive market is opened to every sort of industry than what land-carriage alone can afford it, so it is upon the sea-coast and along the banks of navigable rivers that industry of every kind naturally begins to subdivide and improve itself”. Alfred Weber (1929) argued that "break-in-bulk" locations, i.e. firms look for locations where two or more modes of transportation may connect. R. Goss (1990) stressed how ports drive the economic development as they increase competition through enlargement of the market areas of firms, thereby reducing prices for consumers. Grippaios-Grippaios (1995) argued that rent generated by ports spreads through an economic system larger than the one in which the port is embedded (Ferrari et al, 2012).

Theoretically, seaports are an economic infrastructure with significant multiplier effects on the domestic economy (Tiwari, 2011). When transport systems are efficient, they provide economic and social opportunities and benefits that result in positive multiplier effects such as better accessibility to markets, employment and additional investments (Rodrigue, 2013).

Li-zhuo (2012) argued that the development of port logistics influences the cost and efficiency of the production sector and that investments in the logistics infrastructure have a positive effect on the economy. Better port logistics help reduce the transportation costs in the production sector and increase the efficiency this will have effects on economic growth. The national income will increase several times through positive multiplier effect as a result of the investment in port logistics, because the need of factors of production, materials and new technologies and equipment will be stimulated (Wildenboer,2015).

Economic theory often refers to ports as important factors of economic development as they expand the market opportunity of firms and increase

competition (Rodrigue, 2013). Ports provide regional economy with accessibility to global markets, increasing competitiveness of regional firms through lower import and export cost. Attract new industries related to maritime trade as shipbuilding. Import and export traffic generates a higher added value since it is directly linked to the regional economic network (Brox, 2014). Also higher external trade can translate into higher economic growth. High trade costs inhibit a country from taking advantage of potential gains from specialization and trade in order to promote economic development (Merk, 2013). At the aggregate level, ports increase competitiveness and promote positive economic benefits.

The economic benefits of ports categorized as direct, indirect, and induced impacts.

- **Direct impacts:** The outcome of improved capacity and efficiency where transport provides employment, added value, larger markets as well as time and costs improvements. The overall demand of an economy is increasing.
- **Indirect impacts:** When port investment leads to an increased economic activity, the benefit is measured by the net value of the additional output, the outcome of improved accessibility and economies of scale. Indirect value-added and jobs are the result of local purchases by companies directly dependent upon transport activity.
- **Induced impacts:** The outcome of the economic multiplier effects where the price of commodities or services drops and their variety increases (Rodrigue, 2013).

Port development is a catalyst to stimulate economic activity and creation of employment. In 2011, the United Kingdom despite not being a major trading centre, 262,700 jobs, and \$21.5 billion were generated from maritime services. Every government has a port development plan with aim of increasing the citizens' wealth. Efficient ports could lower transport costs by enabling goods to go to markets in a more timely and cost effectively way (UNCTAD, 2013).

## **SECOND: PORT PERFORMANCE AND NATIONAL ECONOMY**

Improvement in port performance has an impact on national economy as change in port operation, infrastructure and organization has an impact on the efficiency of the supply chain and then on cost. Productivity is the output as function of input and it is a measure of efficiency as the utilization of resources. Efficiency is one of the three basic output dimensions of the organizational performance.

Performance = Effectiveness, efficiency and participant satisfaction

Effectiveness is the accomplishment of explicit or implicit goals, while efficiency is the relation of output to input or benefit to cost. In case of port ratio

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of time, cost, capacity among other constitutes the overall efficiency, which has a considerable impact on the national economy.

Efficiency has impacts on the following elements:

- Ports competitiveness
- Export trade competition
- Price of imported goods
- Balance of payment

If the port is inefficient, freight and handling cost become high, which contributes to increasing the FOB export and import prices. To survive in competitive markets exporters reduce their profit margin. Inefficiency causes under utilizing of resources, declining of the productivity, prolonging of the ship turnaround time, which increase cost per ton (Begum, 2013).

**THIRD: ICT AND PORT PERFORMANCE**

Information and communication technology (ICT) is anything dealing with computers and communications. Shipping operators are dealing with vast amount of data, information systems are needed to collect, process and use these data to reach meaningful information for decision making and to facilitate transport processes between different market players (UNCTAD, 2004). Ports have introduced a number of new information and communication technologies since the introduction of EDI systems in the mid 1980s. The Internet facilitated cheaper data submission through various web-based technologies. In addition, Radio frequency identification RFID adopted by ports years ago which is an automatic identification technology (auto-ID) identifies an object by wireless transmission using radio waves. Other auto ID technologies used as bar code, optical character reader, and biometric technologies (Talley, 2009).

IT business applications in shipping grouped into three main segments:

- ***Electronic documentation and transfer of data*** EDI: cargo tracking, electronic documentation, etc.
- ***E-commerce or e-business***: Online registration and chartering of ships, electronic procurement of supplies, online booking and e-payment systems, etc.
- ***E-marketing***: it is gradually taking over EDI services may include tracing and tracking, virtual deal rooms for document transactions and processing, online publishing, etc. (UNCTAD, 2004)

Modern Logistics also offer information management to customers such as real time tracking and tracing cargo distribution and inventory levels, online documentation and payment services, and information related customs clearance and administrative procedures (UNCTAD, 2004). IT contributes to trade facilitation through more efficient custom procedures as cargo information

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becomes more standardized and exchangeable. Automation can be applied to three intermodal stages which are; first transshipment with loading and unloading sequence, second container tracking and yard management as stacking and third the interface between the terminal and inland transport systems. (Rodrigue, 2010).

Technical efficiency is the most important factor to improve port efficiency (Merk, Dang, 2012). IT reduces costs, time waste and human errors as well as increasing security, immediacy and traceability. Shipping companies highly consider these advantages, which are driving ports towards paperless administration and electronic information management (Brox, 2014). Information technologies in ports improve command flows and supply chain management linked with a better utilization of assets and productivity. IT had multiplying effects on marine transportation over a wide range of applications. IT strengthened supply chain integration through higher level of control over freight flows, security, and cargo issues using EDI (Rodrigue, 2010). Port economic activities in the field of logistics IT developments motivated by achieving economies of scale, merged different processes, through a rapid integration of functions and information in supply chains that have become global. The economic success of a port is related to the capacity of the whole supply chain to derive value for shipping companies and logistics services operators along the freight handling process, which has enlarged the value added of the port (Brox, 2014).

Port competitive advantage extracted from location, infrastructure, transport capacity, integration of ports into logistics chains, effective and efficient port operations, through competitive labor costs and skills, updated and adequate equipment and technology, information systems and port coordination which facilitate the reduction of uncertainty, transaction and transport cost (Brox, 2014). The information systems of the port of Singapore Authority have contributed to improved cargo handling capacity, making the port one of the most efficient ports. The port is linked to dry ports and inland terminals, data sharing should extend to these places to achieve cost reduction and enhance the competitiveness for more users. The Port of Valencia has established a PCS that not only provides services related to maritime transactions and shipping companies on the basis of the existing core port operations, but also incorporates inland and rail transport services (OECD, 2013).

#### **FOURTH: INFORMATION TECHNOLOGY IN LEADING WORLD PORTS**

##### ***Port of Singapore***

Singapore consider one of the most modern and efficient ports in the world, used its resources, expertise, skills, organizations, (Welsh, 2009), artificial intelligence and state of art information, equipment technologies and expert systems (Toh, Phang &Khan, 1995) to build a port of high productivity, efficiency and global presence (Welsh, 2009). Port of Singapore Authority (PSA) uses the most advanced information technology, which separated into three levels.

- In the First level, a program integrates main operations called Computer Integrated Terminal System (CITOS) supports all planning requirements such as berth allocation, ship and rail planning and resource allocation. An ERP system keeps track of all activities related to terminal operations and movements in yard. It also includes regulation of gate operations, equipment maintenance, performance reporting, invoicing, and container number recognition. Operation of break bulk terminal is carried out by another system called Computer Integrated Conventional Operations System (CICOS).
- In the second level, real time management, coordination, and control of operations (Kim et al, 2006).
- In the third level, PORTNET a web based IT software and a community network. Portnet.com limited was formed in May 2000 as a subsidiary of PSA Corporation with its products: P-commerce, eMart, eSolution and Inforhub (Welsh, 2009). PSA offers integrated services to shipping lines, freight forwarders, shippers, and local government agencies through Portnet, via Internet. The system enables online ordering of services as berth application, yard crane booking, ordering pilot, or tug. It also allows tracking the location and status of cargo, regulatory documentation such as electronic delivery order (EDO), container store and release orders and subcontract functions and government permits applications flow through the system. The system also offers financial functions such as online charges and billing, as well as offering easy access data such as detailed schedules, ship planning data, reefer containers temperature, and dangerous goods containers condition. Online connection with custom services supplied through Tradenet (Kim et al, 2006).

##### ***Economic Significance of Port of Singapore***

The port of Singapore has played an important role in the country's economy, transforming it to a first world economy in one generation. Today, Singapore's maritime industry contributes about 7 per cent to the country's GDP, 10 per cent of the services sector which makes up three quarters of Singapore economy (Fabri, 2015). The improved efficiency of the port made Singapore a very open economy.

The value of its external trade is equal to three times its gross domestic product with a per capita GDP that is approximately six times that of the nearest country (Malaysia), and twenty times of (Indonesia).

Since various sectors of an economy are interconnected, all expenditures have a cumulative and magnified effect on the economy through the multiplier mechanism. The revenue generated by the PSA activities such as pilotage, dockage, cargo handling and warehousing can have a magnified impact on Singapore's economy in three ways.

- **First**, the initial injection of spending by ships for direct needs as fuel, food, and water creates direct revenue for PSA, which constitute direct multiplier effect.
- **Second**, PSA purchase the fuel and other needs from producers who will obtain the raw materials from primary producers, which will create indirect multiplier effect.
- **Third**, the recipients of all this direct and indirect spending will spend part of their newly acquired income on goods and services, which collectively constitute induced multiplier effect (Toh, Phang & Khan, 1995).

Singapore ranks first out of 189 countries in ease of doing businesses (World Bank's *Doing Business* survey); for the last several years, it has topped the Economist Intelligence Unit's *Business Environment Index*; and it is second only to Switzerland in the World Economic Forum's *Global Competitiveness Report*. Singapore top in Asia and fifth out of 160 countries globally according to the World Bank's (2014) *Logistics Performance Index* which measures aspects such as efficiency of customs and border clearance, quality of trade and transport infrastructure, and the frequency with which shipments reach consignees within scheduled delivery times. Singapore port, globally, is second only to Shanghai (35.2 million TEUs) in terms of container traffic and is the world's busiest in terms of transshipment cargo with 33.9 million 20-foot containers (TEU) handled in 2014, and connected by 200 shipping lines to 600 ports in 123 countries (Gill, 2015).

#### ***Smart Port Logistics of Hamburg***

Germany top the 160 countries globally according to the World Bank's (2014) *Logistics Performance Index* which measures aspects such as efficiency of customs and border clearance, quality of trade and transport infrastructure, and the frequency with which shipments reach consignees within scheduled delivery times (World Bank, 2014).

Hamburg is the third largest port of Europe after Rotterdam and Antwerp. The city of Hamburg realizes the importance of the port to economic growth. In 2002, the city governors and planners developed a mission to foster new opportunities

for economic growth and to ensure the quality of life within the city, focusing on transforming Hamburg port to a smart port (OECD, 2012). The aim of Smart port is establishing intelligent infrastructure in the port of Hamburg optimizing the flow of information to manage trade flows efficiently. The Hamburg Port Authority (HPA) strives to increase the efficiency of the port as an important link in the supply chain.

**Smart PORT logistics:** is synonymous for smart traffic and trade flow solutions in the Port of Hamburg, taking account of both economic and ecological aspects. A special focus of the project lies on infrastructure, traffic flows, and trade flows. It integrates transport routes, logistics centers, and hubs via a cloud-based IT platform an interactive interface that integrates the relevant data and information of the transport and logistics partners. An innovative approach developed to increase the efficiency of existing infrastructure capacities through new IT systems.

- **Traffic information system:** has been in operation for almost five years now. Its sensors ensure that roads are not overloaded and it automatically provides information about traffic disruptions to prevent trucks from being stuck in jams.
- **Transport Rail:** Additional trade can be accommodated only if in-out times of trains are reduced. The port invested in the expansion of the port railway and installed a new railway IT system, to increase efficiencies. The ultimate aim is to increase the proportion of freight transported by rail as the most eco-friendly mode of transport.
- **Port Monitor:** Since August 2012, the HPA has been using new control station software that was developed for the Port of Hamburg's Vessel Traffic Service Centre. The Port Monitor draws its information from various sources such as electronic charts, vessel positions, water levels, berths, bridge heights and widths, current construction sites, planned diving missions, etc. In a second step the mobile application, "Mobile Port Monitor" was added to the Port Monitor, Information about construction sites and disruptions can now be processed on site and transmitted in real time. The aim is to provide all stakeholders on the water with an overview of the current traffic situation, including the relevant outline conditions such as water levels
- **Parking Space Management:** The mobile app will inform truck drivers about capacities on the individual car parks and allow them to "book" parking bays.
- **Smart Road:** A "more accurate" picture of the actual traffic situation will be determined per each direction of travel.
- **Port Traffic Centre:** In the long term, the traffic information available about all modes of transport will be merged at the Port Traffic Centre, enabling the management of traffic across all modes of transport.



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- **Smart Maintenance:** check on site the road, bridge, and rail infrastructure in the Port of Hamburg, using mobile devices such as tablet PCs or smart phones. These devices communicate online with backend IT systems that process the data and create messages on the spot.

Smart PORT Logistics has become a metaphor for an IT infrastructure that allows controlling the logistics processes in a port in the best possible way (HPA, 2013).

***Economic Significance of Port of Hamburg***

Every eighth job in Hamburg depends directly or indirectly on the port. Throughout Germany a quarter of a million employees are in this way linked to the Port of Hamburg. In 2010, 14%, nearly a sixth of Hamburg's gross value added, was generated by the port, also the port has achieved a GDP figure of €20.6 billion (HPA website last visited 1/2/2016).

A large share of the employment and production value in Hamburg is port related; the sum of direct and indirect port related employment represent 10.6% of total Hamburg metropolitan region employment and 16.3% of city of Hamburg employment. Production value of port related activities is 8.3 billion EUR in 2010. The port of Hamburg has significant indirect effects on the German economy. The port of Hamburg multiplier calculated at 1.71 meaning that one euro of additional demand in the port of Hamburg leads to 0.71 euro of additional supply in the sectors that provide input to the port, which indicate that the port of Hamburg is strongly interlinked with German industries (Mark, Hese, 2012).

***Port of Valencia***

Valencia port is a leading Mediterranean port in terms of commercial traffic, mostly containerized cargo, due to its dynamic area of influence and an extensive network connecting it to major world ports (PVA Web site last visited 5/2/2016).

The Port of Valencia has pioneered the development of ICT system in Spain since the 1980s. The implementation started with the internal development of ITC systems in the Port Authority of Valencia (PAV), customs and terminal operators. Since 1995, the EDI introduced for different administrative documents such as call requests, summary declarations, dangerous good declarations and the reception of authorizations. In late 1990s, the port community started exchanging information on a centralized system. In 2006, an integrated ICT tool allowed for electronic data interchange among all private and public members of the port community, including logistics operators from the sea, the port, and the land segment (carriers, freight forwarders) of the supply chain. The platform known as Port Community System PCS, Which allowed port community actors to enjoy a

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centralized platform acting as a single window for dispatching administrative documents and authorizations between firms along the logistics chain and port public bodies. PCS reduced information costs, increased productivity of logistics operations, improved coordination along the supply chain and reduced operations cost (Brox, 2014).

***Economic Significance of Port of Valencia***

Valencia port is a key player in the modernization and growth of the economy in the Valencia region and Spain in general. This can be seen in the levels of employment and production associated either directly, indirectly or related to the port activities.

Employment: Valencia port provides direct, indirect, or related jobs to 19,800 persons.

Production: Valencia port plays a direct, indirect, or related role in the generation of over 1.74 billion Euros in production.

The economic impact of port activities can be divided into three types:

- ***Direct economic effects***: linked to sectors directly related to port activities as freight forwarders, shipping companies, stevedoring companies, mooring companies, pilotage companies, tugboats companies, customs services and customs agents and the Harbormaster’s Office.
- ***Indirect economic effects***: it is resulting from the impact of ports on the industrial activities sector.
- ***Related or induced economic effects***: derived from the capacity for consumption and investment in companies and economic agents related to port activities.

Table 1 Economic Impact of Valencia Port in Major Economic Areas

	<i>Direct</i>	<i>Indirect</i>	<i>Related</i>	<i>TOTAL</i>
<i>Gross Salaries (x €000)</i>	507.763	113.616	61.545	682.924
<i>Tax Income (x €000)</i>	23.381	9.065	4.515	36.961
<i>Total production (x €000)</i>	1.260.241	290.613	189.441	1.740.296
<i>Jobs</i>	11.020	1.950	6.830	19.800

Source: Valencia Port Authority web site last visited 26/1/2016

These numbers show that for every 10 jobs directly related to port activities, another 8 jobs are created throughout the production and commercialization chain. These data reinforce the relevance of Valencia port in the economic growth of Valencia and Spain (VPA website).

### ***Jebel Ali Port***

Jebel Ali Port operated by DP World UAE Region strategically located in Dubai, at the crossroads of a region providing market access to over 2 billion people. As an integrated multi-modal hub offering sea, air, and land connectivity, complemented by extensive logistics facilities. It is a premier gateway for over 90 weekly services connecting more than 140 ports worldwide.

The IT strategy provide secure, reliable, and increasingly fast and efficient services for the processing of business transactions with all customers, suppliers, Jebel Ali Free Zone companies and government agencies. The organization operates with fully equipped, sophisticated systems, high bandwidth networking infrastructure and support staff with a commitment to embrace new technologies that increase system integrity and productivity. Jebel Ali Port is one of the most modern technologies driven facility of its kind with the following:

- ***Gate Automation system and paperless processing of cargo documentation:*** The customers use the Dubai Trade online platform a single window trade enabler integrates over 200 online services supporting the supply chain industry. More than 85 thousand companies in the trade and logistics sector plugged into the system.
- ***Remote Reefer Container Monitoring System (Refcon):*** It enables port operators to respond quickly to emergencies and eliminate idle periods. Any temperature problems or other irregularities within a refrigerated container or reefer, triggers an alarm in the terminals control office, which then sends a mechanic to investigate. This technology will help satisfy customer's requirements and assure a high standard of operation. The establishment of this system is yet another step towards meeting customer's needs. Reefer operators can track their cargo boxes throughout their journey via remote access.
- ***On-line Payment services:*** Customers can top up their portal deposits and cash guarantees using online payment services. They can make payments against invoices. Modes of payment include credit cards (Visa/MasterCard), e-Dirham and Direct Debit with many banks (JAFZA.ae).
- ***Dubai Trade Services:*** Berth Booking, Monitoring gate moves and Yard inventories, Container release and acceptance, Vessel schedule, Container tracking, Port payments, Electronic timeslot booking, Customs declaration and payment, Truck registration, Container move planning, and so on (DPWorld.ae).
- ***Free Zone Registration, License Management, Zone Administration:*** customers can apply for a visa, request for renewal of a Company Employment Card, apply for employee dependent services, generate a statement of account, generate a list of documents due to expire in a specific period, request for

utility services, update contact details, generate employee contracts for approval by Jafza etc (JAFZA.ae).

***Economic Significance of Port of Jebel Ali***

Jebel Ali Port plays a vital role in the UAE economy, it is a home to the largest port and free zone in the Middle East, contributes a fifth to Dubai's Dh300.83 billion economy. There are 6,700 companies based in Jebel Ali Free Zone, which collectively employ 170,000 people, companies in Free Zone directly employ 135,000, this is about 12.82% of Dubai's total 1.32 million-labor force. Of these companies, about 1,500 are industrial and light manufacturing units while the majority is logistics operations of large corporate. Collectively, they contribute about 20% to Dubai's economy. Jafza's contribution to Dubai's Dh300.83 billion GDP equates to roughly Dh60 billion (Gulf news, 2012). Jafza was home to 838 companies in the metal, steel and construction material segments at the end of June 2015, which included world's top multinationals. In terms of segment breakdown 54% of the companies in Jafza are dealing in construction metal, 36% metal, steel, the remaining 10 % interior, and furniture (JAFZA web site).

**FIFTH: BENEFITS OF ICT IN PORTS**

According to the above, ports automation lower transport costs, increase international trade, and improve economic development according to the improvement of ports performance resulted from the following:

- Secure exchange of information between port actors
- Minimizing of waiting Time
- Optimal deployment of port space and resources
- Fast speed for loading and unloading
- Real time information exchange
- Online management reporting and decision support
- Automatic information registration
- Fast process for trucker
- Real Time monitoring and control of operations
- Saving time and money
- Paperless work environment
- Coordination between transport modes
- More efficient utilization of existing resources
- Optimized work instructions and yard allocation
- Stronger integration of logistics processes
- More efficient management of cargo handling

## **SIXTH: EGYPTIAN MARITIME**

### *Egyptian Ports Status*

The port system seen as potential strong contributor to growth, as the strategic location of Egyptian ports, located at the entrances to the Suez Canal, provide many opportunities to international shipping, particularly for the Eastern Mediterranean region (World Bank, 1998). Maritime transport and related logistics services play an important role in Egypt's economy and international trade with Egypt's maritime ports handling over 65 percent of exports (Ghoneim-Helmy, 2007). The foreign seaborne trade volume of Egypt represents about 90% of the Egyptian foreign trade volume ([www.acaegypt.com](http://www.acaegypt.com)). Egypt has 15 commercial ports of total berths' length of main maritime commercial ports of 32.4 Km, total area of main maritime commercial ports 481.54 km<sup>2</sup>; 27 specialized ports; 7 mining ports; 4 fishing ports; 11 petroleum ports; and 5 tourist ports ([www.acaegypt.com](http://www.acaegypt.com)). Among the most important ports are Alexandria, the biggest port in Egypt, and the Port of Dekheila, which is a natural extension to the Port of Alexandria. Damietta Port has the largest container terminal, while Port Said and Port Suez occupy strategic positions at each end of the Suez Canal ([www.acaegypt.com](http://www.acaegypt.com)).

In 2001, the Government adopted the Landlord model for managing and operating the ports as a means to restructure and increase the competitiveness of Egyptian ports. Under this approach a public port authority role to develop the port, invests in its infrastructure and serves as regulator for all maritime, security and environmental activities. The private sector operates facilities and services under a contractual agreement with the port authority, usually through a lease or "Build-Operate-Transfer" BOT contract for an agreed period. The model has been successful in development of Ain Sokhna and Port Said East (World Bank, 2006).

Major investments took place in Port Said and Damietta ports. Port Said divided into two parts, port said and port said east, the first featuring 800 thousand TEUs capacity, and the second with 2.7 million TEUs. The infrastructure spread over an area of 90 hectares with a draft ranging from -14m to -16.5m and it comprises of 21 quay cranes. Trade rose from 1.62 million TEUs in 2005 to 3.96 in 2013 with targeted 5.4 million TEUs within its infrastructure development plans. Damietta port built in 1988 over 62.5 hectares and comprises of 4 quays, the draft is -14.5 m with an annual capacity of 1.2 million TEUs with future projects aimed to expand its handling capacity up to 4 million TEUs. In addition, development of the Suez Canal as part of economic development path using transport, maritime and port sector at the center of a number of infrastructural and organizational investments aimed at recovering efficiency in worldwide trades

which improved Egypt's position in the World Bank indicator 35 positions in Logistics Performance Index LPI from 2007 to 2014 (Deandries, 2015).

Although of the mentioned development, there are some characteristics of Egyptian ports lower their international competitiveness:

**Infrastructure Deficiency:** In some ports, there is poor infrastructure and poor maintenance of equipment, which contribute to higher handling charges and more time (World Bank, 2005). According to Global competitiveness report quality of port infrastructure in Egypt ranked 66<sup>th</sup> out of 144 countries in 2015 (World Economic Forum, 2015). According to LPI issued by World Bank Egypt position infrastructure indicator deteriorated from 45<sup>th</sup> rank in 2012 to 60<sup>th</sup> in 2014 out of 160 countries (World Bank, 2012, 2014). The main constraints include the inefficiency of the national shipping fleet, weak port infrastructure, ineffective implementation of regulations, rigidity in price setting of port fees and services dues, over staffing and lack of trained personnel (Ghoneim- Helmy, 2007).

**Inefficient Port Operations:** Inefficiencies at Egyptian ports contribute to higher logistics costs, as example freight fees are high compared with other destinations in the Mediterranean destinations (Ghoneim-Helmy, 2007), which lessen the competitiveness of trade, and may increase imported goods cost. In addition, bureaucratic procedures affect efficiency, including time needed to clear customs (World Bank, 2005). Egypt seems to have problems with the timeliness of shipments and with prices of international shipments as it deteriorated from 64<sup>th</sup> rank in 2012 to 99<sup>th</sup> in 2014 (Deandries, 2015).

**Inefficient Logistics Services:** According to LPI issued by World Bank Egypt position deteriorated from 57<sup>th</sup> rank in 2012 to 62<sup>nd</sup> in 2014. Competence and quality of logistics services indicator deteriorated from 50<sup>th</sup> rank in 2012 to 58<sup>th</sup> in 2014, while ability of tracking and tracing consignments improved from 66<sup>th</sup> in 2012 to 43<sup>rd</sup> rank in 2014. Egypt categorized as partial logistics performer with a level of logistics constraints (World Bank, 2012, 2014). In comparison to Middle East countries Egypt shows a logistics gap as United Arab Emirates, Qatar, Turkey, Saudi Arabia, Bahrain occupy positions 27<sup>th</sup>, 29<sup>th</sup>, 30<sup>th</sup>, 49<sup>th</sup>, and 52<sup>nd</sup> respectively (Deandries, 2015).

**Modest Level of Automation:** Container terminals in the ports of Alexandria, El-Dekhila, Port Said and EL Sokhna have been automated with state of the art software for container terminal operations. Currently there is no communication between ships and container terminal prior to arrival except in Alexandria, El dekhila and EL Sokhna. There is no exchange of loading and unloading plans between the terminal and ships, which could save time and costs. The implementation of EDI is likely to face several obstacles due to cultural and organizational complexity of port authorities (Ghoneim- Helmy, 2007).

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Table 2. Comparative Ports Indicators

Country	LPI	Customs	Infrastructure	International Shipments	Logistics quality and competence	Tracking and Tracing	Timeliness	Quality of port infrastructure
Germany	1	2	1	4	3	1	4	14
Singapore	5	3	2	6	8	11	9	2
Hong Kong, China	15	17	14	14	13	13	18	53
Spain	18	19	20	21	12	26	17	9
United Arab Emirates	27	25	21	43	31	24	32	3
Qatar	29	37	29	16	28	32	34	24
Turkey	30	34	27	48	22	19	41	57
Saudi Arabia	49	56	34	70	48	54	47	40
Bahrain	52	30	49	58	51	42	119	15
Oman	59	74	57	31	73	80	67	33
Egypt	62	57	60	77	58	43	99	66

Source: created by researcher based on The Global Competitiveness Report 2014-2015. World Economic Forum- The Logistics Performance Index and Its Indicators 2014, World Bank

**ICT at DP World Sokhna Port**

According to direct contact with marketing specialist at DP world Sokhna and further information from the port web site, the study found that the DP World Sokhna is the first fully automated port in Egypt including the following services.

- **One stop shop solution for customers:** is a single entry/exit point via Customers Service Center, every department in the port has its own operation system. The systems are connected and integrated together forming a community for the customer, who just has to go to customer service department and submit his documents and it will go through the systems automatically.
- **Mobile Telephony (SMS):** The customer receives SMS with his customs inspection date to observe and release his container. It contains Auto Notification Messages such as Inspection Appointment, Container Ready-In-Yard, Customs Payment Request, General Organization for Export and Import Control (GOEIC) Payment Request. Receive/Send Messages as Inspection Appointment, Taxes & Charges Due, and Declaration Status.
- **Front Office Services:** It includes data entry of Customs declarations and GOEIC Inspection Requests. Document scanning and transfer to transaction records, issuance, & delivery of Customs, payment requests, and delivery of customs clearance.

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- **Video Conferencing:** System eliminates direct contact between consignees and customs officers. It designed to facilitate settlement & arbitration negotiations. It includes capability to record and manage requests for conference meetings, and records conference sessions. The Sessions linked to business transaction records.
  - **Plasma Monitors:** Display on-line information such that scheduled inspections, declarations with remarks, ready-for-payment transactions, customs disputes
  - **Kiosks:** provides online enquiry responses to port customers. It provides natural keyboard data entry and or touch screen technology. It complements the Port Front Office services.
  - **An internal complaints system:** the customer can submit his complaint to the commercial department, direct it to the concerned department, and follow it up until closed.
  - **Online services:** online services on the website ([www.dpworldsokhna.com](http://www.dpworldsokhna.com)) where customers can calculate storage invoice and Performa invoice.
  - **Smart phone application:** track customer shipment.
  - **Customs EDI:** receive electronic cargo manifests and send customs clearance messages, in order to facilitate rapid ship and cargo processing.
- Availability of fully computerized terminal handling and planning system as all important vessels, shipping, customs, and port processes are fully automated and integrated into the information technology system. Usage of the most sophisticated systems such as: system for managing and tracking gate, terminal, yard operations, and cargo movement, Oracle E-Business Suite in Financial, Enterprise Asset Management and maintenance management on a single platform, and Customs system integrated with operation.

**ICT in Egyptian Ports**

According to the above information, the study found that Egyptian ports would face the following strengths, weaknesses, opportunities, and threats to implement world competitive advanced ICT systems in Egyptians ports.

Table 3 SWOT Analysis of IT Implementation in Egyptian Ports

<b>Strengths</b>	<b>Weaknesses</b>
<ul style="list-style-type: none"> <li>- Strategic location of Egyptian ports.</li> <li>- Government awareness of importance of maritime sector in Egypt.</li> <li>- Maritime transport and related logistics services play an important role in Egypt's economy.</li> <li>- foreign seaborne trade represents about 90% of the Egyptian foreign</li> </ul>	<ul style="list-style-type: none"> <li>- Lack of port infrastructure and support facilities.</li> <li>- Expensive system fees.</li> <li>- Shortage of qualified personnel.</li> <li>- Bureaucratic and regulative inefficiency in ports.</li> <li>- Insufficient equipments.</li> <li>- Inefficient maintenance and repair.</li> </ul>



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<p>trade volume</p> <ul style="list-style-type: none"> <li>- Government adopted the Landlord model to increase the competitiveness of Egyptian ports</li> <li>- Public port authority investment in infrastructure</li> <li>- Development of the Suez Canal</li> </ul>	<ul style="list-style-type: none"> <li>- Inefficient connection between marine and railway infrastructure.</li> <li>- Inadequate technology.</li> </ul>
<p><b>Opportunities</b></p> <ul style="list-style-type: none"> <li>- Improvement of ICT in Egypt</li> <li>- Awareness of the importance of ICT to business</li> <li>- Large number of ICT graduates</li> <li>- Large number of ICT companies and experts</li> <li>- ICT systems in world ports which can be imitated</li> </ul>	<p><b>Threats</b></p> <ul style="list-style-type: none"> <li>- Un stable political environment</li> <li>- Inefficient transport infrastructure</li> <li>- Bureaucratic and regulative inefficiency in public sector</li> <li>- Traffic congestions</li> <li>- Weak business environment</li> <li>- Lack of innovation</li> <li>- Low R&amp;D budget</li> <li>- Weak institutional framework</li> </ul>

Source: Created by researcher

**CONCLUSIONS**

Based on the current study and previous academic studies, information technology can contribute to solve structural and administrative problems in Egyptian ports, which in turn will increase ports performance and positively affect economic development. Egyptian ports performance need improvement to strengthen their economic role which require the following:

- Reduction of ports operating costs.
- Shortening the time needed for container movement.
- Raising port capacity.
- Real time monitoring and control operations.
- Better marketing campaigns.
- Coordination between transport modes.
- Advanced ICT solutions.
- Efficiency automation.
- Cooperation and integration within port.
- Advanced and reliable information.
- Fast exchange of data for decision making.

## **RECOMMENDATIONS**

A successful port information system needs the following procedures to avoid any bottleneck in system development and to ensure system efficiency:

- Legal regulations to ensure flexible business environment within the port.
- Well established information technology infrastructure before implementation of the system to avoid system failures.
- Updating business processes within the ports to be consistent with the system.
- Upgrading ports equipments to operate in harmony with the new system.
- Strengthening port infrastructure and support facilities.
- Strengthening institutional support.
- Coordination between public and private community members.
- Upgrade port personnel language and technical skills including ICT skills as well as understanding of new technologies as RFID to be able to use the new system efficiently.

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